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HIGH-TENSION RAILROAD LINE CROSSINGS.

The attention given to standards of high-tension line construction during the past few years by large public-service corporations affords admirable evidence of the efforts of such organizations to maintain safe operating conditions throughout their territory. Step by step the details of line design and particularly the details of crossings where high-voltage circuits pass over or under other wires have been improved on the basis of operating experience, until it is probably true that what was once a weak spot in line construction is now the safest in the entire overhead system, and the last to fail in the face of extraordinary weather conditions. In the earlier days of high-tension crossing protection the methods were relatively crude, compared with those in use today, and yet there has long been a remarkable freedom from trouble on lines where even the most elementary protective arrangements have been installed in a workmanlike manner. The familiar "stitch in time" has thus been put into practice with most effective results.

Elaborate specifications for high-tension crossings have been prepared by the American Telephone & Telegraph Company, which was a pioneer in this work. More recently the Public Service Commission of Vermont took the matter in hand in connection with unfavorable conditions of line construction and operation in the vicinity of the city of Montpelier, and issued exhaustive instructions for the improvement of crossing and parallel line installations. In the railroad field, the New York Central Lines have taken up the question in detail, and the requirements of this company are of sufficient interest to be suggestive to transportation companies elsewhere who are confronted with the problem of safeguarding their rights of way and overhead signaling circuits.

Without attempting to cover these requirements in detail, it is noteworthy that the railroad company requires complete detailed plans of the crossing to be passed upon by its engineering department before any work is done, and that the power company is required to bear the brunt of all patent causes which may arise, to obtain all necessary permits, and to stand behind all its material and workmanship, giving the railroad company full inspecting powers both in the shops and in the field. Minimum clearances of thirty feet above the top of the rail and six feet above existing

wires are required, and the minimum clearance between any conductor and its supporting structure or the nearest metal surface in any direction is set at twelve inches up to 24,000 volts, the clearance being increased one-half inch for each additional step of 1,000 volts. The minimum clearance between conductors is set at twenty-four inches up to 24,000 volts, with a one-inch increase for each additional 1,000 volts. Special care has been taken to provide for the use of self-supporting towers and non-corrosive transmission cable on crossing spans, the minimum size for potentials above 5,000 volts being set at No. 0 B. & S. gauge for copper and No. 00 for aluminum. The company requires that the cable crossing the railroad shall be designed to support safely, in addition to its own weight, a layer of ice one-half inch in thickness, weighing sixty pounds per cubic foot, and combined with a horizontal wind pressure of twenty pounds per square foot on the projected surface of the ice-covered cable. The maximum allowable stress upon the cable is to be four-tenths of the ultimate strength of the material; no splicing of the cable or any of its strands is permitted in the open over the railroad, and in the computation of stresses and clearance, and in erection, provision has to be made for a temperature range of 130 degrees Fahrenheit.

The railroad company wisely permits the use of wooden poles for less than 12,000 volts. Exhaustive specifications are drawn for the use of structural steel towers, conforming in general to the Standard Specifications of the Association of American Steel Manufacturers. A minimum material thickness of 0.25 inch is required, except for fillers; the minimum size of angles is set at 2 by 2 by 0.25 inches; and of rivets or bolts, 0.625 inch. The shape of sections is required to be such that inspection, cleaning, and painting are readily accomplished, with the prohibition of spaces in which water or cinders can collect. The location of rivets with relation to the edges of the pieces, use of fillers, loading of towers, qualities and properties of steel, character of galvanizing, elastic limit, allowable unit stresses, ultimate strength and bending tests, painting, and protection of pins, pinholes, etc., against rusting are thoroughly covered. The design of concrete foundations for poles and towers, and the character of pins, insulators and other attachments used are carefully reviewed. The railroad company requires a factor of safety of two for pins and other attachments under extreme conditions of stress on the conductor, and requires this to include the unbalanced pull due to a broken wire. Locking of pins to prevent rising out of the hole in the cross arm, the use of porcelain insulators instead of glass, with a double factor of safety, and a design that will hold the conductor to the supporting structure even if the insulator is mechanically broken are called for. The usual grounding of steel towers is required, with the provision of an auxiliary insulator with steel cable for grounding the line wire in case of its disconnection from its insulator. The company also insists upon the protection of the conductor at the point of attachment to the insulator, so that if the latter breaks down electrically the resulting arc will not burn the conductor, as by interposing between the conductor and the insulator a metal shield with an air space between the shield and the bottom of the groove in the insulator head. The completeness of such specifications marks a departure from empirical methods and temporary standards of construction which is most encouraging. Continuity of service and the prevention of accidents are of constant and growing importance in electrical transmission.

ELECTRICAL PRACTICE IN MINES.

The standardization and regulation of electrical practice in mines has never received in this country the attention which it deserves. The conditions which exist in mines are decidedly different from those found elsewhere, both with respect to the effects upon the materials used and to the effects which may be produced by personal contact, by leakage, sparks and short-circuits. Much of the wiring has been installed without reference to these unusual conditions, many mines are without a competent electrician, many never receive adequate inspection, and as a result many are in a truly deplorable condition. Both the safety of the mine workers and the protection of the property demand that better consideration be given to the subject, especially in those cases where no competent engineer or electrician is in charge of the installation. The safety of the mine workers is a consideration which puts the whole matter in the category of things which should be controlled by legal enactment and competent governmental supervision.

The American Mining Congress appointed a committee early in 1909 to consider this matter and placed at its head Dr. E. B. Rosa, of the Bureau of Standards. The facilities of the Bureau were placed at the disposal of the committee, and one of the members of its staff devoted a great deal of time to collecting information and personally observing conditions. At the following convention of the Mining Congress the committee was discontinued, but so much work had already been done that it was considered advisable by the Bureau to complete it and publish the results. This has been done, and under NEW PUBLICATIONS in this issue will be found a notice of the circular recently sent out.

Among other things, the circular contains a code of rules for electrical installations, which, while perhaps not perfect, may well serve as a basis for legal regulations which are urgently demanded by the conditions in many of our states. Two of the requirements are worthy of especial attention. One is that every mine which is electrically equipped shall have a competent electrician in charge. The other is that each state shall include among its mine inspectors electrical inspectors who have demonstrated their competence to pass upon electrical equipment by passing a spe-

cial examination. The latter provision is especially important, for without proper inspection to insure compliance with the regulations the mere passage of legislation is utterly insufficient to improve the conditions, and executive authorities are usually unable to pass upon such matters without the assistance of technical advisers.

One most important thing in connection with legislation upon this subject is that the different states shall pass uniform laws in dealing with the subject, exceptions being made only to meet conditions which may be unique in some particular locality. It is unfair to the operator in one state to subject him to restrictions which may require a financial outlay, when his competitor across the state line may be free from such restrictions. While this is a strong argument in favor of simultaneous and uniform legislation, it is not of sufficient importance to cause the more progressive states to postpone legislation because others are tardy. The disadvantages are to a large extent balanced, if not overbalanced by the increased safety to life and property secured by proper installations and adequate inspection.

There is already in existence in this country a body whose aim is to secure uniform legislation in the various states. It has been largely occupied, however, with nontechnical matters of wide popular interest, such as divorce. To secure proper consideration for a matter of this kind it would be advisable to hold a convention of mine inspectors or other interested state officials from the departments of mines, who are conversant with local conditions, and draft a uniform code which could be submitted to the legislatures of the various states for action. Such a convention should include also, by invitation, representatives of the electrical manufacturers, mine operators, and mine workers, and electrical and mining engineers. The approval of such a body would go far towards influencing favorable consideration by the legislators.

AN ELECTRICAL LABORATORY FOR THE BUREAU OF STANDARDS.

The Bureau of Standards has been in existence now nearly ten years, and has shown the country what may be expected of it both as it exists at present and in the natural course of its future development. Its nucleus was the Office of Weights and Measures of the Coast and Geodetic Survey, where in addition to maintaining standards of weight and measures of length, capacity, etc., a start had already been made in temperature and electrical measurements. Both of the latter have developed into full fledged departments of the present bureau and are doing very important work, and in addition there are sections devoted to photometry and other optical measurements, to chemistry, to material testing, to chronometry, to magnetic measurements and to the liquefaction of gases. In addition there is a power plant and an instrument shop.

The two latter departments of the Bureau are housed in the Mechanical Laboratory, the first of the present group of buildings forming the home of the Bureau. It was completed in 1904, and was closely followed by the Physical Laboratory, which contains the offices, library, and the sections for chemistry, weights and measures, chronometry and optics. The cryogenic work is carried on in a separate laboratory and last year a fourth building was erected, which is devoted to temperature work and material testing.

Aside from the preservation of the fundamental standards, there is perhaps no feature of the work of the Bureau which has been of more importance or more value to the manufacturing interests than the electrical section. In addition to the maintenance of standards, the calibration of instruments, resistances, inductances, standard cells, condensers and lamps, and other routine testing, it requires only a glance at the six volumes of the Bureau *Bulletin* to indicate the great value of the research work and other investigations which have been carried on. Two recent examples of this work are the circular upon "Standardization of Electrical Practice in Mines," which means much to the manufacturer as well as the mine worker and mine operator, and is referred to elsewhere in these columns, and the report upon the use of flame standards in photometry, which was abstracted in our last issue.

It is now proposed by the Director of the Bureau to erect a separate laboratory to be devoted to the work in electricity, magnetics and photometry, and an estimate for this purpose has been submitted for the consideration of Congress at its next session. At present this work is scattered through three of the four present buildings and is uncomfortably crowded. The conditions under which the work in instrument testing and magnetics is conducted are decidedly unfavorable and better faciltiies and rooms designed especially for the purpose are urgently needed. The importance of this work to manufacturers and others engaged in the electrical field cannot be too highly estimated and there should be no question about supplying the best facilities for prosecuting the work in the future.

When we consider the enormous sums devoted yearly to the maintenance of our military and naval establishments, rising into the hundreds of millions, it does not seem unreasonable, even during an administration devoted to economy, to ask an extra appropriation to be devoted to purposes so helpful to our manufacturing interests, to say nothing of their scientific value. There is always danger, however, that administrative and legislative officials will not appreciate the necessity for expenditures of this kind, and will not realize that money devoted to such purposes is an investment yielding ample dividends in the help it offers to one of the large industries forming an important spoke in the wheel of national prosperity. We trust that in this instance an appropriation will be forthcoming.

Chicago Electric Club.

At the weekly noon-day meeting of the Chicago Electric Club held on November 2, Donald M. Carter, of the patent-law firm of Parker & Carter, delivered a highly interesting address on "The Inventor as a Factor in Civilization."

Mr. Carter rapidly reviewed the work of the inventor, his importance in the development of civilization, the making of an invention and the protection of the inventor's rights. Many inventors have wrongfully been called cranks because their ideas were so far ahead of the times as to seem impracticable. However, as a class, inventors have done more for the human race than any other of its leaders. If it were not for the inventors we would still be naked savages. It is not so many centuries back that women, on top of their other household duties, had to work in the fields, grind the grain and spin the cloth. Every material feature of our civilization, such as clothing, food, housing, transportation, etc., has been developed as the result of the labors of thousands of inventors who have worked tirelessly and quietly for the advancement of the race. But these inventors are practically all unknown and relatively few in the last century alone have received credit for their work.

An invention consists in the conceiving of an idea and carrying it into execution. Many men contribute advanced ideas, but do not complete the invention by finding a way to put the ideas into practical form. This country early took the lead in recognizing the rights of inventors. In fact, its patent law has made our country the great commercial nation that it is. However, the intangible nature of an invention greatly complicates the manner of protecting it. Real estate and personal property are easily protected because of their material existence to which title can readily be proven. An invention, on the contrary, must be described in words in order to fulfill the legal requirements of the patent laws.

In the claims is the vital point of any patent application. The claims must state exactly what is the nature of the invention. This, however, is practically impossible and a close approximation only is feasible and yet this must be broad enough to cover a number of modifications that would readily suggest themselves in carrying out the invention. If the inventor himself tries to draw up the claims, he is almost sure to overlook vital features which, if they did not prevent his securing a patent, would make it practically valueless. An expert patent lawyer is needed for this work.

Mr. Carter cited the invention of the telephone by Bell and how his carefully drawn patent claims withstood the fiercest legal onslaughts. On the other hand, the patent on the invention of aeroplanes that was granted to the Wright Brothers a few years ago had eighteen claims, of which only a few were sustained by the courts; the Curtiss biplane was held not to be an infringement of these remaining claims. To most people, however, the Curtiss biplane is a duplicate of the Wright machine. Had the Wright patent been more carefully drawn, it would have been unimpeachable. To the Wright Brothers undoubtedly belongs the credit of making heavier-than-air machines practicable; to them, therefore, should have been given the inventor's full rights. All this, Mr. Carter said, only shows that the present United States patent laws do not properly protect the inventor. However it be, through the work of the inventor the long-dreamed-of millenium will surely be brought about.

At the conclusion of this address a brief but witty speech was made by Senator Niels Juul.

New Institute Branches.

By vote of the board of directors of the American Institute of Electrical Engineers two new student branches of the Institute have been authorized at the Throop Polytechnic Institute, Pasadena, Cal., and at the State University of Kentucky, Lexington, Ky. This makes the total number of college branches thirty-four.

New York Electrical Society.

The New York Electrical Society has issued a programme of meetings for the present season which includes the following topics:

"Animated Photography in Natural Colors, by the Kinemacolor Process," by Gilbert H. Aymar.

"The Effect of the Telephone on Modern Industrial and Social Life," by Herbert N. Casson.

"The Catskill Water Supply," by Charles N. Chadwick.

"Electricity at the Panama Canal," by David B. Rushmore.

"Hydroelectric Development in Mexico," by F. O. Blackwell.

"The Rapid-Transit Problem of New York City," by H. St. Clair Putnam.

"Wave Motion by Electricity and Other Energy," by Charles P. Steinmetz.

"The Physics of Light Sources," by Edward P. Hyde.

"The Relation of the Modern Incandescent Lamp to the Central Station," by S. E. Doane.

A visit will also be made to the laboratory of Thomas A. Edison at Llewellyn Park. Mr. Edison will give a talk on "The Edison Storage Battery and its Applications," the laboratory will be inspected, and there will be an exhibition of moving pictures.

Ornamental Tungsten Street Lighting in Burlington, Iowa.

The start of an extensive system of ornamental street lighting with tungsten clusters has just been made at Burlington, Iowa. Two blocks on South Main Street, from Market to Elm Streets have been equipped and the system has met with such favor that it is to be extended over practically the entire business district. The standards are ornate Doric columns each bearing five 100-watt tungsten lamps, one upright in the center and four supported in a pendent position by brackets. The standards are spaced, as nearly as possible, eighty feet apart. The entire cost of installation and operation of the system will be borne by the merchants and property owners along the streets lighted. Current is supplied by the People's Gas & Electric Company.

Cheap Current for Electric Vehicles.

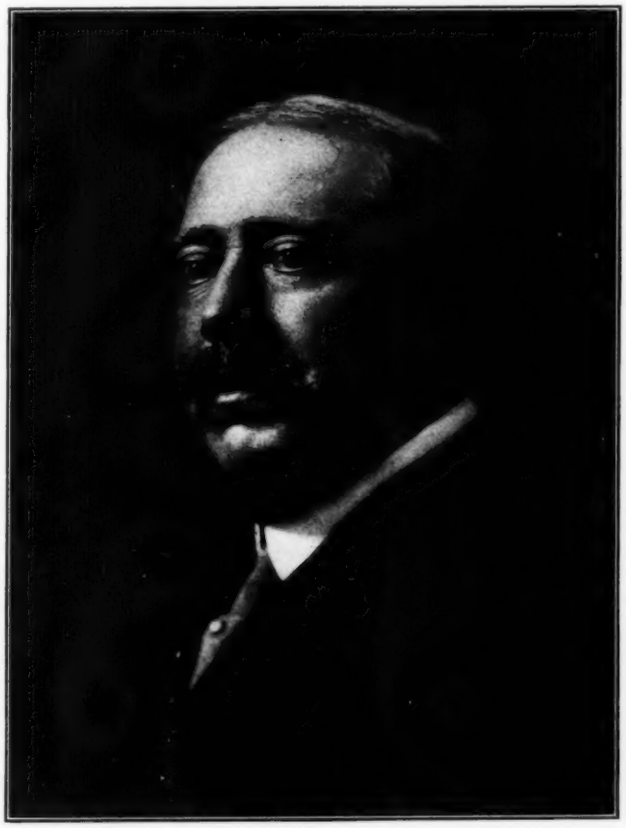
The borough of Marylebone, London, England, proposes to adopt a rate of one cent a kilowatt-hour for charging electric-vehicle battery, the current to be used between 11:00 p. m. and 6:00 a. m. with a minimum demand of 100,000 kilowatt-hours a year and no obligation to supply during foggy spells.

Membership of the Illuminating Engineering Society.

The present membership of the Illuminating Engineering Society is 1,475. This is a net increase of 437 since the beginning of this year.

Cyrus O. Baker.

The subject of this sketch has had a long and honorable connection with the electrical industry. Although not in any way associated with what is generally assumed to be a distinctive part of electrical engineering or manufacture, the industry of which Mr. Baker is the leading figure has been absolutely depended upon to produce a refined material which has entered into almost every branch of electrical engineering and to take the place of which we have thus far discovered no practicable substitute. The precious metal which Mr. Baker makes his specialty and of which his company is the largest refiner in the country and possibly in the world, is, we all know, platinum, and he is frequently alluded to as the Platinum King of America.



CYRUS O. BAKER,
Long a Prominent Figure in Electrical Circles, and the Leading Refiner of Platinum in the Country.

Cyrus Osborne Baker was born in Newark, N. J., October 12, 1857. He is the son of Daniel W. and Harriet N. (Baldwin) Baker. His father and mother represented two very old New Jersey families and his father was president of the Common Council of Newark for many years, and the first controller of the city of Newark. His mother's people were prominent in the business, professional and social life of Philadelphia.

Mr. Baker received his early education in the public schools of Newark, and finished in the Newark high school. At the age of sixteen he sought employment with his father who was a manufacturing jeweler, and he learned thoroughly each department of the manufacturing jewelry business. He gradually found his most congenial work in the refining and chemical end of the jewelry business, and in 1878 he organized under his personal name the business for the refining of platinum. This business was established largely with his father's capital, and later on his father became a partner, his brothers coming into the business as they became of age.

In 1902, the firm was incorporated as Baker & Company, Incorporated, at that time and since being recognized as the most extensive refiners of platinum in the United States.

Mr. Baker is connected with a number of other manufacturing and financial institutions, but his most important holdings are associated with the mining and refining of gold, silver, copper, platinum and their allied base and precious metals.

He is a director of the National State Bank of Newark, one of the oldest institutions of the country, and in this connection he has again followed the example of his father who was at one time president of the Republic Trust Company of Newark.

He is a Son of the American Revolution, a member of the Essex Club of Newark, the Essex County Country Club, the Union Club of Newark, the Olympic Club of Long Island, the Lotos Club of New York, American Institute of Mining Engineers, New York Electrical Society, Magnetic Club, and for personal services has been made an honorary member of the National Electric Light Association. It will be remembered that for years Mr. Baker was master of transportation and as a matter of fact until the death of George Porter, who succeeded Mr. Baker, there had been practically but two masters of transportation in the history of the organization.

Mr. Baker's personal association with the leaders of the electrical industry dates back to around the early eighties. It was at this time that he became a charter member of the original Electric Club in 1886. This may sound like a long time ago, but it is in reality but a breathing space away to one of the rugged and vigorous personality of Mr. Baker.

Mr. Baker takes a quiet but influential place in the political and social life of his community, and his beautiful home in East Orange is the center of attraction for a group of close personal friends and acquaintances.

Electric Mining in Mexico.

In the enlargement of its machinery equipment the Negociacion Minera de San Rafael y Anexas, of Pachua, Mexico, has provided for a motor installation totaling 2,000 horsepower, the larger motors taking power direct from the main circuit at 2,000 volts, and the smaller motors at 440 volts from several groups of transformers. Motor-driven pumps are used in the cyanide plant for handling slimes, sands and solutions, each tube mill is operated by a 100-horsepower motor, while in the stamp mill a 75-horsepower motor is employed to drive each group of twenty stamps.

Quartz Lamps for Photography.

A writer in a German technical paper has made an inquiry into the efficiency of various artificial light sources for photographic work. The quartz lamp stands easily at the head of the list.

Turkish Clothing Factory to Electrify.

The Turkish War Ministry has officially announced that the military clothing factory at Ismid will shortly be equipped for operation by electric power.

Commonwealth Edison Section of the National Electric Light Association.

The annual banquet of the Commonwealth Edison Section of the National Electric Light Association, held in the Gold Room of the Congress Hotel at Chicago, November 1, was one of the most successful in the history of the section. About 450 members were present, and a great deal of enthusiasm was manifested.

Following the banquet proper, the newly elected officers were announced by Chairman Manley. These were as follows: E. F. Smith, chairman; O. J. Bushnell, vice-chairman; E. J. Doyle, secretary; Wm. A. Fox, treasurer. Members of the executive committee are: A. D. Bailey, E. H. Lakeman and Guy Lunn.

A number of musical selections were given by R. T. Conger, Harold Wright, and the members of the Commonwealth Edison organization, after which several speakers made comment upon various phases of the work of the section.

Some brief remarks on the value of "Push," by John F. Gilchrist, were followed with a few comments by President Freeman, who came from Brooklyn to be present at the banquet. Mr. Freeman spoke on the value of the various company sections especially complimenting the spirit displayed by the Commonwealth members.

Samuel Insull touched upon the development of the modern central-station company, and emphasized the value of membership in the National Electric Light Association to employees of these companies. L. A. Ferguson, who spoke along the same lines, compared the Association of today with that body as it was when he was president in 1900.

E. F. Smith, the incoming chairman, then briefly outlined the proposed method of management for the coming year.

The enthusiasm displayed throughout this meeting was indicative of the efforts which are being made for the betterment of the section; efforts which are being rewarded by a constantly increasing membership.

Electric Lighting in Johannesburg.

The municipality of Johannesburg, S. A., has recently placed an order for 4,000 Osram lamps to be used for street lighting.

Electrical Exports for September.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has just issued its monthly summary of the exports and imports of the United States for the month of September. From this it is noted that the electrical exports (both appliances and machinery) show a considerable improvement over those of a year ago, but a decrease from the figures of the preceding month.

The trend of these exports is seen from the comparative figures of the first nine months of this year and the corresponding periods of 1909 and 1908. The steady growth of the appliance exports and the resumption of heavy machinery shipments is shown by the following:

	Nine months ending September 30.		
Electrical—	1910.	1909.	1908.
Appliances	$ 7,353,696	$5,113,907	$4,145,897
Machinery	5,383,858	4,588,522	5,530,060
Total	$12,737,554	$9,702,429	$9,678,957

The comparative monthly data are as follows:

Electrical—	September, 1910.	September, 1909.	August. 1910.
Appliances	$ 762,152	$ 686,049	$ 852,958
Machinery	578,246	480,835	708,160
Total	$1,340,398	$1,166,884	$1,561,118

The principal countries to which electrical exports were sent in September and the values of these shipments were as follows:

	Electrical	
Countries—	Appliances.	Machinery.
United Kingdom	$ 23,106	$ 36,856
Other European countries	16,939	57,124
Canada	212,758	106,665
Mexico	94,910	116,144
Cuba	32,377	2,507
Brazil	180,394	29,415
Other South American countries	70,866	30,612
Japan	43,209	129,665

National Electric Light Association Proceedings.

The National Electric Light Association is now issuing to its members the annual Proceedings. These two volumes include the report of the thirty-third convention held at St. Louis last May, and mark the twenty-fifth anniversary of the Association. The volumes include 2,070 pages and 483 illustrations. Among the latter are a fine portrait of President Frueauff and several elaborate colored engravings in the paper on Street Arcs, by Mr. Ryan. The Proceedings embrace some seventy papers and committee reports, all of which are carefully indexed and an abstract is given of each paper or report for ready reference. A year ago the edition was 4,500 sets. This year, owing to the rapid increase in membership, the edition is not less than 7,000 sets, and it is interesting to know that these represent about twenty-eight tons of printed matter. Many of the state and company sections are now so large that these books are delivered to the local secretaries, in bulk, by freight or express. The publication this year is ahead of the usual date and it is hoped that the strike amongst the express companies in New York City, will not interfere materially with the delivery of the books to the membership.

Examinations for Draftsmen.

The United States Civil Service Commission announces that two examinations will be held at the regular places on December 7 and 8. Eligibles are to be secured from these for the position of cartographic draftsmen at $3.84 per day and for fortification draftsmen at $1,500 per annum. Those desiring to take either of the above examinations should apply at once to the secretary of any board of examiners or to the United States Civil Service Commission, Washington, D. C.

Subjects for Discussion in Iowa.

The president of the Iowa Electrical Association, Thomas Crawford, has sent to the members requests for an indication of the subjects which they would like to have discussed at the next meeting, which takes place in Davenport next April. This will permit members who wish to hear discussions on any particular subject pertaining to the industry to make their wants known and if possible have them attended to.

Iowa Electrical Association.

The next convention of the Iowa Electrical Association is, according to present plans, to be held at Davenport, April 19, 20 and 21, 1911. The exhibits are to be held in the main room of the Davenport Coliseum, while a sound-proof room in the building has been secured for the meeting of the sessions.

Steel Conduits for Electrical Wiring.

The British Engineering Standards Committee, 28 Victoria Street, Westminster, London, England, has recently issued its Report No. 31 containing a revised specification for steel conduits for electrical wiring.

The Telephone Plant of the New Pennsylvania Terminal.

A Model Equipment Installed in New York.

BY J. N. C. GRAHAM.

Few railroad officials devote as much time to the consideration of their telephone needs as do those of the Pennsylvania system. Long before its magnificent New York Terminal Station, shown in Fig. 1, and its wonderful tunnel aproaches assumed definite form, these officials, in conjunction with the Telephone Company, made a careful study of the probable requirements. As with everything else in connection with the New York improvements, they took a broad view of the telephone situation and operating efficiency was the deciding factor in the study. As a result of this policy, the Pennsylvania Tunnel & Terminal Railroad has a telephone system which is above the average as regards scope and flexibility.

The Pennsylvania Tunnel & Terminal Railroad is the New York extension of the Pennsylvania Railroad. It connects with the New York division of the Pennsylvania system near Harrison, N. J., and extends over the Jersey Meadows, under Bergen Hill, the North River, the Borough of Manhattan and the East River, through Sunnyside Yard to a connection on the Long Island Railroad near Woodside Avenue, Borough of Queens, Long Island, a total distance of about fifteen miles.

This railroad will probably soon be the most important division of the Pennsylvania system. It is distinctive in many respects. It represents the highest standards in engineering, architectural and railroad practice. Use has been made of every practical convenience. All known inventions which will in any manner add to the safety and comfort of its patrons or which will increase the operating efficiency of the road have been utilized. Although the telephone was not invented until several years after the New York extension was first conceived in 1871, it occupies a high place among the safety and efficiency promotors which have been installed in connection with this great work.

All of the apparatus for the telephone system is of Western Electric manufacture and is furnished by the New York Telephone Company, which has provided for three classes of service, i. e., commercial service, operating service and pay-station service.

EQUIPMENT FOR COMMERCIAL SERVICE.

The commercial equipment, as the name implies, has been installed to care for the telephone service between the railroad company and the public. It comprises: (1) A main private-branch-exchange switchboard having trunk lines to the telephone company's nearest central office; tie lines to other private branch exchanges in offices of the Pennsylvania and Long Island Railroad Companies in New York and other cities; extension lines to the various offices of the Pennsylvania Tunnel & Terminal Railroad Company and of the Long Island Railroad Company located in the Terminal Station. (2) A private-branch-exchange switchboard for use in connection with the Bureau of Information.

The main private-branch-exchange switchboard (Fig. 4) is located on the Eighth Avenue side of the second floor

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FIG. 1.—PENNSYLVANIA TERMINAL STATION, NEW YORK.

of the Terminal Building, which is located between Thirty-first and Thirty-third Streets, Seventh and Eighth Avenues. The operators' quarters and the room which contains the terminal equipment, auxiliary apparatus and power plant for operating the switchboards (Figs. 5 and 9), are adjacent to the switchboard room. These three rooms overlook the

FIG. 2.—PLATFORM TELEPHONE.

main concourse and have been arranged with a view to caring for a 100-per-cent increase in the already large telephone business of the railroad.

The switchboard is of the standard common-battery type, has a capacity of 1,000 lines, which are multipled in

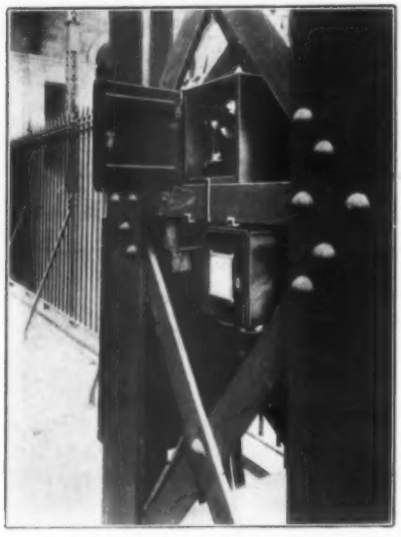


FIG. 3.—GATEMAN'S TELEPHONE.

every second position, and is at present equipped for 520 lines, of which 40 are arranged for trunk lines to the telephone company's central office, 80 are arranged for tie lines, 80 are arranged for magneto extension lines, and 320 are arranged for common-battery extension lines.

There are six operating positions, of which two and one-half positions are arranged for handling incoming traffic and three and one-half positions are arranged for handling originating traffic.

A day force of six attendants and a supervisor are necessary to handle the traffic on the board. A smaller number of attendants are required during the evening and at night. The work of the attendants is supervised from a regulation chief-operator's desk.

Current for operating the switchboard is furnished from eleven cells of No. 11-F Chloride accumulator. This battery is charged by means of a three-kilowatt generator, which is direct connected to a 5.5-horsepower motor.

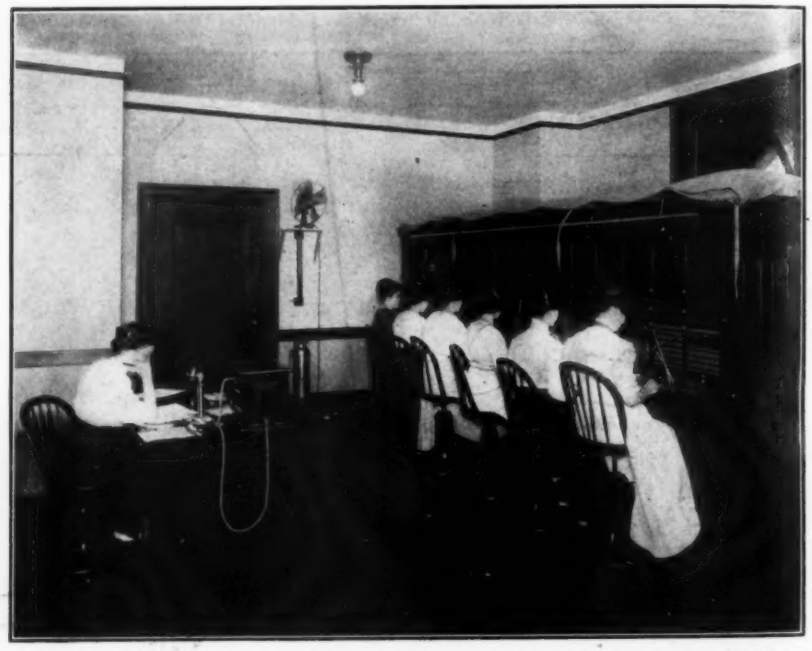


FIG. 4.—MAIN PRIVATE-BRANCH-EXCHANGE SWITCHBOARD AND SUPERVISOR'S DESK.

Ringing current is normally furnished from the telephone company's central office. A seventy-five-watt, direct-driven ringing machine is provided for emergency use.

Three-phase, 400-volt, 60-cycle, primary current for operating both the charging and ringing machines, is furnished from the railroad company's service station.

Most of the telephones furnished in connection with the commercial service are of the standard types with which everyone is familiar. The only exceptions are the instruments furnished for the use of the conductors and gatemen. In these cases, standard units have been installed in a manner to meet the railroad company's requirements. The units are contained in boxes located in the columns on the train platforms and at the gates opening off of the main concourse (Figs. 2 and 3).

The switchboard serving the Bureau of Information has four positions. It is of a new type, similar to those designed to meet the requirements of the telephone company's information service.

A call to the information board operates a lamp signal in each of the four positions of the switchboard, and can be answered by any one of the operators. The act of answering the call puts a visual busy signal on that particular line in all positions. Limited facilities are provided for transferring public calls from the information switchboard to the main switchboard and to the Pullman office. The board is operated by means of keys. No plugs or cords are used. It is designed to permit of practically unlimited growth.

Normally information calls from the public are received on the trunk lines. In case of emergency they can be received over the tie lines to the main switchboard. If it is found that a person calling the information switchboard desires to talk to some department of the railroad or to make Pullman reservations, the call can be transferred by the information operator to the main switchboard or to the Pullman office. It has been found that with a switchboard of this type,

team work in handling information calls can be highly developed.

EQUIPMENT FOR OPERATING SERVICE.

The operating equipment has been installed primarily for use in connection with the dispatching of trains and the operation of the railroad. It is arranged, however, to permit of connections to the commercial system. Such connections may be made only in emergency cases.

The equipment comprises: (1) Twenty-five monitor switchboards located in the offices of the train dispatchers, yard masters, station masters, switching cabins, power houses, etc. (2) A number of magneto telephones located at conates the main private branch exchange.

In places where the monitors are operated by not over two attendants and are within easy reach of these attendants, the lines terminate in ordinary magneto signals or drops (Fig. 10).

Monitors which are intended merely for outgoing business or for use on an official's desk have no drops or signals.

All of the monitors are really terminal switchboards. They provide a convenient method of terminating at one point a number of lines which are used by those who have to do with the dispatching and switching of trains from that location. The circuits are arranged to permit of making a limited

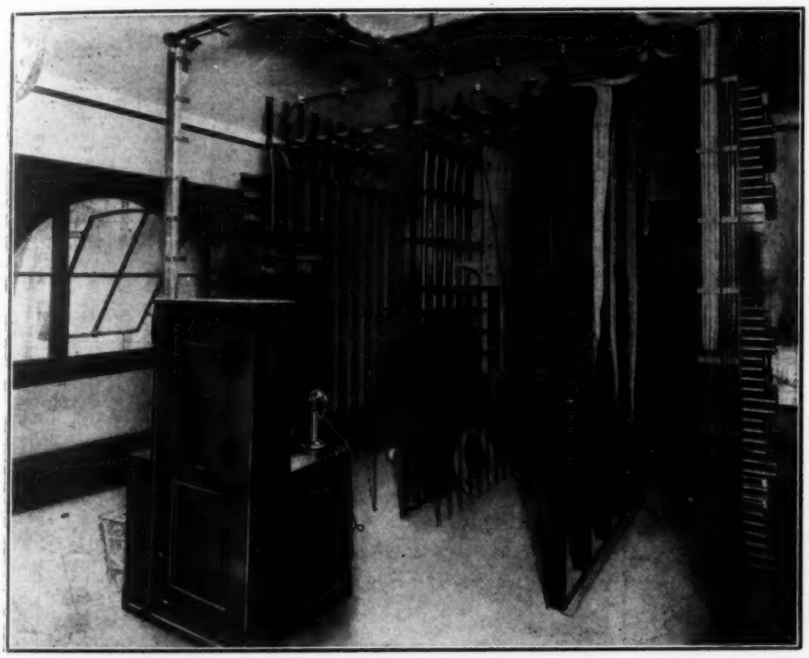


FIG. 5.—MAIN AND INTERMEDIATE DISTRIBUTING FRAMES, RELAY RACKS, AND WIRE-CHIEF'S DESK, MAIN PRIVATE BRANCH EXCHANGE.

venient points in the tunnels, yards and along the right of way of the railroad. Some of these stations terminate in the monitor boards above referred to and others terminate in the main private branch exchanges, all being arranged to permit of the greatest operating efficiency and flexibility.

The monitor boards have a capacity of from ten to thirty lines each. They operate on a magneto basis and are of three general types.

In locations where the operating traffic is heaviest and where several employees are required to handle the general business, the monitors are provided with lamp signals (Fig. 6). Current for operating these signals is furnished from the battery which oper-

number of connections between the extension stations terminating in the respective monitors. In each case the monitors have been designed to allow for installing in the most convenient space in the various offices, switching cabins, etc., in which they are used.

The convenient location of the many telephones on the station platforms and in the various yards, towers, cabins, offices and tunnels, makes it possible for any railroad employee to communicate promptly with any department and thus care for any emergency which may arise.

The telephones used in the tunnels were designed to meet the unusual conditions experienced in submarine tunnels. The apparatus is treated to resist moisture and is contained in an iron case, the front of which forms two doors. These doors are hinged on the under side, so that, when open, they are flush with the face of the set, thus reducing to a minimum the chances of people injuring themselves by bumping into them while walking along the tunnel platforms (Fig. 7).

FIG. 6.—MONITOR SWITCHBOARD AND APPARATUS CASE FOR TRAIN-DISPATCHER'S DESK.

Fifty-three of the tunnel sets are installed on the walls at intervals throughout the six tunnels (Fig. 8). All of the wiring to the sets is done in conduit. The substantial construction between the cable terminals which are in iron boxes, and the tunnel sets

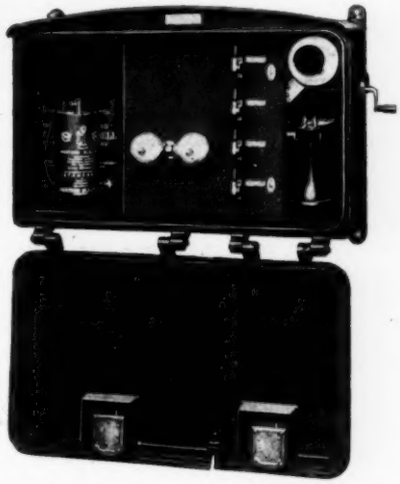


FIG. 7.—TUNNEL TELEPHONE SET.

and the signal bells, is well shown in the cut.

Normally the tunnel sets are not connected to any circuit. They are arranged so that connection can be made by means of switching keys to either one of four circuits. These circuits terminate as follows:

One for each tunnel in the main private-branch-exchange switchboard.

One for each tunnel in the train dispatcher's monitor switchboard.

One for each tunnel in the power director's monitor switchboard.

One for each tunnel, spare.

This is a very flexible arrangement and, in case of emergency, permits of direct connection in the shortest possible time to those interested; also, it permits of the maximum of transmission efficiency, as ordinarily only one instrument will be in service on a single circuit at any given time.

In addition to the four circuits above mentioned, there is a fifth circuit in each of the tunnels to which are connected a number of loud ringing bells used for signaling. Employees of the various departments having business in the tunnel may thus be called to the nearest telephone by means of code signals.

FIG. 8.—TUNNEL TELEPHONE SET.

EQUIPMENT FOR PAY-STATION SERVICE.

The pay-station service is of three kinds: (1) Standard pay-station service, where the patron makes a call from a booth. (2) Restaurant pay-station service, where the patron makes a call from the table while dining. (3) Train pay-station service, where the patron makes a call from a telephone located on a train.

Groups of booths for standard pay-station service have been furnished in the main waiting room, ladies' waiting room, exit concourse and Long Island concourse.

The principal pay station is located in the main waiting room, which is the largest in the world. The equipment consists of a three-position switchboard, a cashier's desk, an assignment clerk's desk and thirty-six instruments in kalameined bronze, receding-door booths.

A new feature of the installation is the method of caring for patrons, to prevent the usual congestion incident to a busy telephone pay-station. A number of telephone directories are located on convenient shelves in the main waiting room. After looking up the number in one of these directories, the patron enters the pay-station enclosure and gives the call to a clerk who assigns a booth. The patron then passes through a turnstile to the booth. In the meantime the clerk enters the call and the booth number on a toll check which is passed to the switchboard attendant; also, the clerk pushes a button numbered to correspond with the booth. This operation lights the inside and outside booth lamps and lamps on the clerk's desk and on the cashier's desk. These latter lamps act as busy signals and thus avoid assigning two persons in the same booth. All lamps remain lighted until the connection is taken down by the switchboard attendant.

Upon receipt of the toll check, the switchboard attendant makes the connection, enters the time and passes the check to the cashier. When the patron is through talking and hangs up the receiver, the switchboard attendant is signaled and takes down the connection. This puts out all of the lamps associated with the connection. The restoration of the cashier's lamp is a signal to her to be ready to collect. The patron must walk past the cashier when leaving the enclosure, as the turnstile prevents leaving by the entrance. The booth lighting and the booth busy signals can be operated either from the monitor's or cashier's desk. In periods during which only one or two attendants are required, the booth lights can be controlled from the switchboard, independent of the monitor's or cashier's desk.

Patrons desiring to make local calls, need not go through the routine above described, as there are ten booths equipped with automatic prepayment stations, so located as to make it unnecessary to pass through the turnstile to use these booths.

The equipment in the ladies' waiting room consists of a one-position switchboard and ten instruments in kalameined bronze receding-door booths. The switchboard is located in back of a bronze and plate glass counter between two banks of five booths each.

The kalameined bronze, receding-door booths in the main and ladies' waiting rooms were specially constructed for the railroad company from the telephone company's specifications. The booths and all of the fittings in connection with these two pay stations were designed to harmonize with the general scheme of the station. They have glass-paneled doors and plate-glass shelves to support the instruments. They present a fine appear-

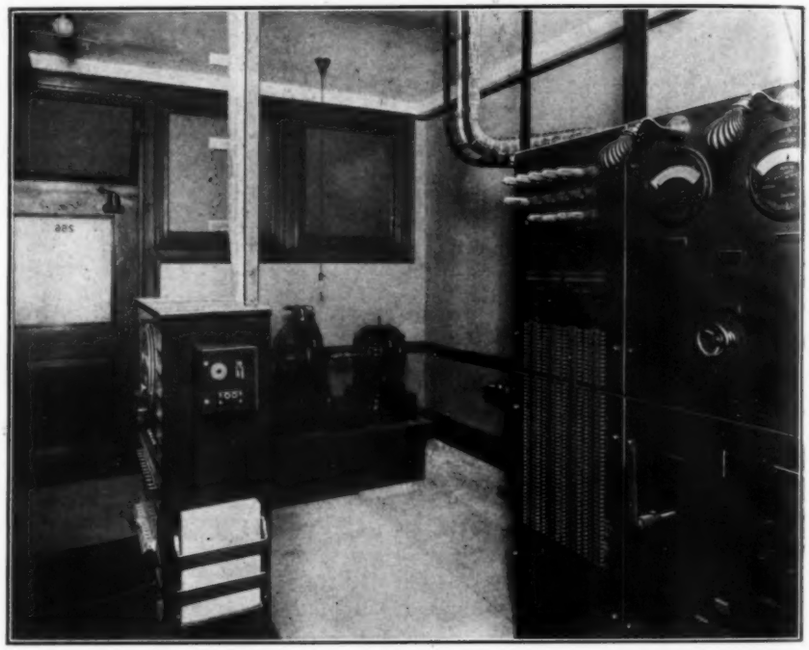


FIG. 9.—POWER SWITCHBOARD, CHARGING UNIT, AND WIRE-CHIEF'S DESK, MAIN PRIVATE-BRANCH EXCHANGE.

ance against the Roman Travertine stone used for decorating the interior of the station.

The exit-concourse pay station is in a room which opens off of the exit concourse. The equipment consists of a one-position switchboard and ten instruments in oak, receding-door booths.

The Long Island concourse pay station is located on the Long Island concourse opposite the ticket office. The equipment consists of a switchboard and six instruments in oak, receding-door booths.

At all of these pay stations, with the exception of the main pay station, collections for calls are made by the operator or a messenger attendant in the usual manner.

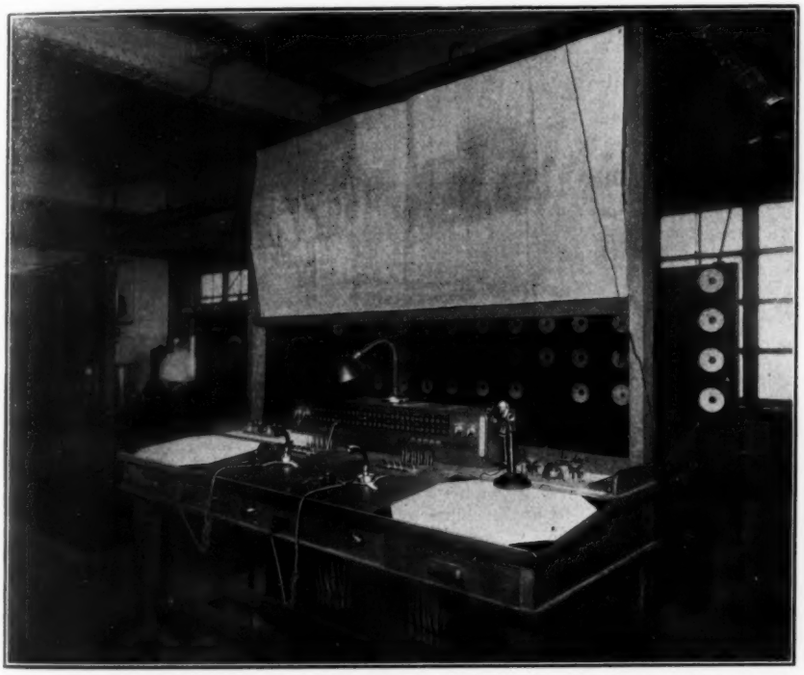


FIG. 10.—MONITOR SWITCHBOARD ON POWER-DIRECTOR'S DESK IN THE POWER HOUSE, LONG ISLAND CITY.

In making the pay-station study, much thought was given to the probable direction of traffic, in order to provide adequate facilities in the most convenient locations. The main thought of the railroad and telephone companies in assigning the pay-station space was to provide adequate telephone facilities for the public. The arrangements in this case are exceptionally well planned and it is expected that patrons will be able to obtain the maximum pay-station efficiency with minimum discomfort to themselves.

The restaurant pay-station equipment consists of two switchboards, one located in each restaurant. Extending from these switchboards are a number of lines which terminate in jacks at each table in the restaurant. A person wishing to make a telephone call while dining, asks the waiter for a telephone. A portable telephone is brought to the table and connected to the jack above referred to, and the call made in the regular manner. The amount of the charge for this call is placed on the restaurant check.

Lines extend from the main private-branch-exchange switchboard to jacks located at convenient points under the train platforms. The observation cars of the more important trains are equipped with telephones which also terminate in jacks under the car. A flexible cable is used for connecting the train jack and the platform jack, thus making a connection to the private-branch-exchange switchboard and enabling passengers to make telephone calls until a few seconds before the departure of the train. These pay-stations are in charge of the stenographer in the observation car.

CABLE AND WIRE PLANT.

Some idea of the magnitude of this work can be obtained from a few figures in connection with the cable and wire plant of the system.

Adequate facilities have been provided for reaching any point within the terminal area or along the road where there is a possibility of a telephone being required. In the terminal building alone, which, measured by area covered, is one of the largest ever constructed at one time, there has been installed for use in connection with the commercial service, 6,900 feet of lead-covered telephone cables. These cables contain 450 miles of copper wire and weigh 11 tons. The largest cable contains 1,212 wires and weighs over seven pounds to the foot. It was necessary to make 43 branch splices, in one of which 2,828 wires were connected. These branch cables connect to 80 cable terminals containing nearly 5,000 binding posts. To extend the lines from the cable terminals to the various instruments within the terminal building required 39,000 feet of twisted-pair wire.

In addition to the cable plant above referred to, approximately 30 miles of lead-covered telephone cable containing 240 miles of copper wire has been installed in the terminal area and along the right of way to connect the operating equipment. This is all large-gauge cable and weighs over one hundred tons. In all cases this cable has been installed in ducts in the tunnels and along the right of way on the side opposite to the high-tension power lines. Special attention has been given to the proper protection of all the lines and equipment.

Conference Favors Interborough Plans.

The Brooklyn Transit Conference recently reported to the Public Service Commission, of New York, urging the adoption of the Interborough Company's subway plans, rather than the Tri-Borough subway plans now under consideration. The Interborough's plan is for an extension down Seventh Avenue terminating at a tunnel under the river opposite Liberty Street, thence connecting the present subway in Manhattan.

European Copper Statistics.

The total visible supply of copper November 1, was 88,420 tons, a decrease of 5,550 tons since October 1. During the month stocks decreased 4,020 tons and afloat decreased 1,530 tons.

The London fortnightly statistics show stocks of copper decreased 1,965 tons, and the visible supply decreased 3,740 tons.

Safety of Electrical Workers.

The following report of James E. Cole, Commissioner of Wires, Boston, Mass., to John F. Fitzgerald, the mayor of that city, and reprinted here from the Boston *City Record*, "intimately concerns the safety of the citizens in general and particularly that of the electrical workers whose business compels them to handle wires charged with dangerous currents of electricity:"

"It appears advisable that some legislation be taken limiting the potential of electric currents that may be legally transmitted by the medium of overhead wiring. At present there is no specified limit, and the potential of alternating-current circuits in this city has been increased from time to time from 1,000 volts potential to (in some cases) 13,200 volts, which, in certain sections of the city, is at present transmitted by means of overhead wires, and this potential is liable to be still further increased. In my judgment this is unwise and unsafe and should be prohibited. While it must be recognized that from a commercial standpoint, on the part of the consumer as well as the producer, the utilization of extra high potentials is necessary, in my opinion the conductors used for the transmission of same in this city should be underground.

"At the present time the upper crossarm and top of each pole is reserved by section 15, chapter 38, of the Revised Ordinances for the exclusive use, free of charge, of the departments of the city. Were the poles carrying only wires of so-called signaling systems such as fire alarm, police signal, telephone, telegraph, etc., this would be an admirable ordinance, but, under existing conditions, its desirability in its present form is, to say the least, questionable.

"While from the standpoint of increased safety it would be desirable that so-called signaling wires and the wires for electric light, heat and power purposes should be run on separate lines of poles, wires of one class being on one side of the street, the wires of the other class to be on the other side, conditions are such that this is impracticable, and it is necessary in many cases that electric light and power wires and wires of so called signaling systems be attached to the same poles.

"Under the existing conditions, with the city wires or wires of other signaling systems at the top of the pole, and the light and power wires attached to crossarms underneath, it is necessary for the linemen who work upon the signaling wires to pass up between the wires carrying electric currents dangerous to life, which, in my judgment, is an unnecessary hazard to subject them to; furthermore, the relative strength of the two classes of wires is such that under the stress of severe storms the wires of the signaling systems are more liable to break than those of the other class, and, falling, often come in contact with the light and power wires attached to crossarms beneath, thereby becoming charged with currents at high potential dangerous to both life and property.

"I would suggest the advisability of so amending ordinance referred to as to provide for the reservation of lower crossarm on poles for the use of city wires, rather than the upper crossarm as at present specified, thereby, in my judgment, removing one of the worst hazards to which linemen on signaling systems are at present subjected.

"Under the provisions of chapter 347, Acts of 1908, the amount of streets that may be legally prescribed for the removal of poles and the placing of wires underground is two miles. In my judgment this is an inadequate amount, and I would suggest that when the proper time to bring such matters before the Legislature arrives, a bill be introduced increasing the amount which may be prescribed by the Commissioner of Wires.

"I desire to take this opportunity to refer to another matter relative to overhead construction perhaps not necessarily called for by your communication.

"In section 15, chapter 38, of the Revised Ordinances, previously referred to, one of the provisions prescribes that wires shall not be attached to poles for the support of wires at a height less than twenty-five feet above the ground.

"There are at present many miles of wire scattered throughout the city which do not conform to the city ordinances in this respect as they are not placed on the poles the requisite distance above streets. Wiring referred to is all old construction antedating the present administration of this department.

"Above reference to wires attached to poles at a height less than that called for by the ordinances is particularly applicable to electric railway feeders for the support of which trolley poles are utilized, and which, while not conforming to the ordinances, is better, not only for the company interested but better from a practical standpoint for our citizens, than it would be to install an additional line of poles for wires in question that would keep wires the required distance from the ground, the regulation trolley pole not being of sufficent height to do this.

"In line with previous suggestions I would suggest the desirability of amending existing ordinance so as to make the required distance twenty-one feet instead of twenty-five feet as at present. This would take care of such wires as are at present attached to poles too low to conform to present ordinances, and would enable a thirty-five-foot pole to do work for which at present a forty-foot pole is needed.

"Poles in our streets are objectionable but necessary, and a thirty-five-foot pole, being shorter and less in diameter, is less objectionable than a forty-foot pole, and does not increase but tends to decrease the dangers from the wires."

Low-Pressure Turbines and Electrification.

Some curious consequences arise from the praiseworthy enterprise of steam-plant owners who make haste to take advantage of the low-pressure turbine. In a recent example the owners of two adjoining textile factories have been enabled to scrap two small steam engines by coupling an exhaust turbine to a third and larger engine. In order, however, to secure the benefit of the change it was necessary, of course, to design a scheme of electrical transmission, and it is at this point that a thorny subject of debate is touched. The advantage of the electrical drive is, as is well known, largely a question of doing away with shafting and countershafting. In fact, in many cases the decision rests on a comparison of the transmission losses due respectively to shafting and to drop in cables and electrical efficiency between the steam engine and the machinery to be driven; while at the same time it is now established that the more even turning obtained by means of the electrical drive is a valuable improvement. In the example under review, however, one of the scrapped engines has merely been replaced by an electric motor of equal horsepower, leaving the shafting as before, and by this method it will not be surprising if the total load on the steam plant is somewhat greater than it was before. There will still be a net saving due to the great reduction in fuel consumption, but it is regretable that such an opportunity was missed for obtaining the full benefit of electrification.—*Times Engineering Supplement.*

China's Electrical Awakening.

According to a report by the British Commercial Attaché at Pekin on the foreign trade of China in 1909, contracts were given out during 1909 for new electric light installations at Chungking, Chengtu, Changsha, Nanking, and Ningpo, and for more or less important extensions at Shanghai, Hankow, Peking, Swatow, Mukden, and other places. Negotiations were proceeding at the beginning of 1910 for a large installation at Hangchow and for installations in several cities in Manchuria. Furthermore, an electric street railway for Canton is under contemplation, a considerable extension of the telephone system in that city has recently been carried out; preparation are being made for inaugurating telephone services at Chengtu, at Wuhu, and in the provinces of Kiangsi and Chekiang.

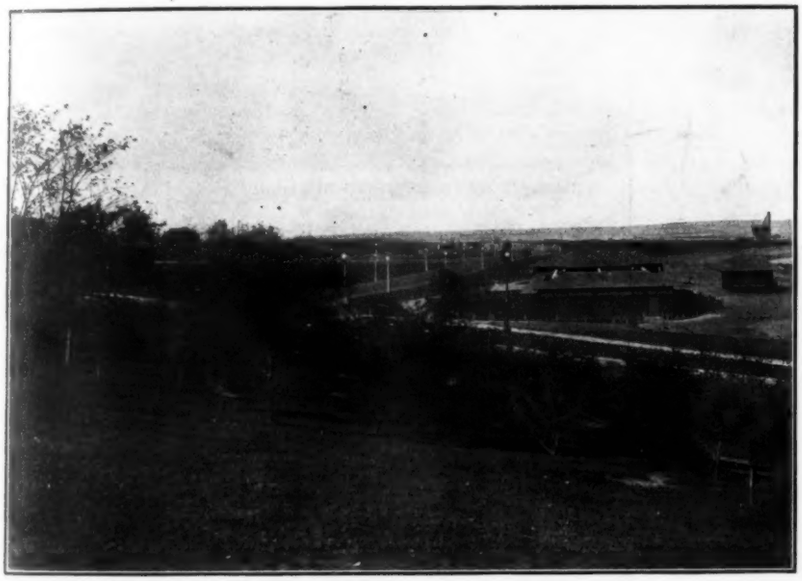
Belgian Government Adopts Metric System.

American Minister U. Grant Smith sends from Brussels the decree of the Belgian Government of August 17, which makes the use of the metric system of weights and measures obligatory for all public documents, notices, and advertisements, and for all papers, public or private, produced before a court, notary, or other public official. The use of any other standard, except the marine knot and ton and in dealings with foreign countries, is made punishable by a maximum fine of fifty francs ($9.65), and the confiscation of the weights and measures which may be used.

EXTENSION OF THE LINCOLN PARK ELECTRICAL SYSTEM.

UNDERGROUND LIGHTING, POWER AND TELEPHONE CIRCUITS.

Of the various governmental bodies in and near Chicago that have availed themselves of the electric power from the hydroelectric generating plant and transmission system of the Sanitary District of Chicago, probably the most progressive is the Board of Lincoln Park Commissioners, which has jurisdiction over the park and boulevard system on the North Side of the city. Nearly two years ago the power house in Lincoln Park was changed to a substation receiving Sanitary District power and utilizing it for electric lighting and electric pumping. The economies resulting from this change have been so marked that the Commissioners have been enabled to improve and extend the electrical system both in Lincoln Park and the main boulevards leading to it.



VIEW OF NORTH EXTENSION TO LINCOLN PARK, SHOWING NEW ARC LAMPS AND PUBLIC BATH HOUSE.

This work has consisted chiefly in the provision of electric arc lighting along new driveways and boulevards and along several that were formerly lighted by gas; also remodeling of the arc lighting on some boulevards.

At the same time these extensions and improvements were made in the lighting circuits, there was installed a telephone system, principally for park and boulevard police service, whose circuits also were placed entirely in underground cables. These undertakings were begun over a year ago along Lincoln Park Boulevard for one and a half miles south of Lincoln Park. Here an attractive new arc lighting system was installed that was described in this journal in the issue of December 25, 1909. The additional arc lighting provided for this year is of the same type, namely what is known as the Daniels boulevard-lighting system, with each lamp entirely inclosed in a glass globe and mounted on an ornate concrete column. The details of these lamps and columns were described in the article referred to.

The Lincoln Park Commissioners have practically decided to employ the Daniels system of lighting for all new and remodeled lighting circuits. Low cost of the conduit construction, low cost of the concrete columns (these are molded by park employees and the labor and material cost is only about $11.50 per column), also low cost of the current purchased under a favorable contract, as well as low maintenance cost, have all contributed to make this lighting system a very economical one to install and to operate, so that it has been found desirable to use it even for driveways of secondary importance.

Thus at the southern edge of the park gas lamps were removed this spring and the new arc lamps installed on North Avenue from Lincoln Park Boulevard to Clark Street, also on State Street and Dearborn Avenue from North Avenue to Burton Place. About 15,000 duct feet of conduit were laid for the thirty-four lamps in this installation. At the western edge of the park a similar change is now being made along North Park Avenue for the half mile from Center Street to Fullerton Avenue. The installation of thirty-two arc lamps will be completed here before the close of the year.

As Lincoln Park is the only large park on the North Side and is at the same time the most popular one in the city, it was determined to extend it northward by reclaiming a strip of land along the shore of Lake Michigan. Within a year this initial extension of half a mile up to Belmont Avenue will be completed and thereby add practically thirty-three per cent to the area of the park. Plans have been prepared for gradually pushing this extension four miles farther north, so that when this work is entirely finished the park will be six miles long with a continuous driveway, in connection with the present Lincoln Park Boulevard at the southern end, of about eight miles along the lake shore. The western driveway of this north extension was completed this summer and along it fifty-eight of the new arc lamps were installed and lighted about a month ago. The underground circuits for these lamps required about 50,000 duct feet of conduit.

The only boulevard now running north from Lincoln Park is Sheridan Road. It is a much traveled connection between Chicago and its numerous North Shore suburbs. A section of it nearly two miles long from Grace Street to Foster Avenue is now being decidedly improved by the substitution of the new arc lamps for the old gas lamps. This installation is to have 158 arc lamps and is to be finished by next February. Its complete equipment, including lamps, columns, underground conduits, four series arc circuits in the substation, also all labor of installation, will be about $40,000. With the equipment of two intervening sections, each about three-quarters of a mile long and which will probably be undertaken soon, there will be presented a continuous line of the new boulevard arc lighting six miles long.

In connection with laying the mains for these lighting circuits, all of which

are underground, some very interesting conduit work has been done. As it was desired to have no overhead lines at all and as it was desirable to keep the conduit costs down to a reasonably low figure, it was determined to put the park system's telephone lines underground in ducts directly adjoining the lighting ducts in the same trenches. A number of power circuits leading to various buildings in the park were also placed in the same conduit runs, also some incandescent lighting circuits. Telephone engineers, who were consulted about this plan, were dubious of its success. Nevertheless, it has proven entirely satisfactory and perfect service has been given since last June. Although the telephone ducts adjoin up to eight or even twelve ducts of 6,700-volt single-phase lighting circuits and 4,000-volt three-phase power circuits, no cross-talk or inductive troubles of any kind have been experienced. No heat or sneak coils have been blown. All telephone lines are metallic circuits placed in paper-insulated and lead-covered cables. Over seven miles of this cable have been laid from Ohio Street on the south to Foster Avenue on the north.

A private-exchange board has been placed in the office of the Commissioners in the Academy of Science Building at the Center Street entrance of the park. This has a capacity of 100 lines, of which 55 are now in service. About half these lines are for police service and the remainder run to the various park buildings. A small exchange board of the Chicago Telephone Company adjoins the one referred to and serves to connect to the city lines. The total cost of equipment and installation of the private telephone system, including part of the conduit costs proportional to the number of telephone ducts, was about $12,000.

In the older manholes the telephone cable was covered with several layers of asbestos listing, which was then saturated with silicate of soda, thus giving a hard fireproof protection and guarding against any possible trouble in the high-voltage cables. In the newer manholes a horizontal niche or recess four inches deep was left in the brickwork along one side of the manhole; the telephone cable was laid in this and the niche then plastered up with fire clay flush with the inner wall, thus giving even a still better protection to this cable from possible mechanical or electrical injury.

All the conduit laid in the Lincoln Park system in the last three years has been bituminized fiber duct. This was chosen on account of its relatively low cost, the facility and low cost of laying, and the ease of rodding and drawing in the cables. A good idea of the method of laying this conduit is shown in the accompanying illustrations of the work on a six-duct conduit run in the park.

LAYING BITUMENIZED FIBER DUCT.

PARTIALLY COMPLETED SIX-DUCT CONDUIT.

The trench is dug to a depth of about three and a half feet and a layer of concrete is put in and tamped down. Three men do the actual work of handling the duct, one dipping the ends of the duct into hot bitumen and the other two men taking the long sections and laying them in place in the trench, one of these men fitting the flush counterbored ends together and the other pushing the duct in to make a tight joint. This work goes on with great speed because the number of pieces of duct handled for any definite length of conduit is relatively small, the joints are quickly made and little trouble is experienced in lining up the duct. Where the conduit consists of several layers of ducts, concrete is put be-

tween each course, thus also filling in the space between adjacent ducts. Concrete is put over the top layer of ducts and the whole conduit is thereby made an integral structure. A portable concrete-mixing machine was used and the entire work was carried forward with great celerity.

DIPPING THE ENDS BEFORE LAYING THE DUCT.

Almost all the manholes have been constructed of brick with a concrete slab on top. Just west of Diversey Beach, however, the conduit was only four feet above the lake level. For this run, therefore, the manholes were made shallow and entirely of concrete. These were molded at the concrete shop in the park and then sunk into the excavations that had been dug for them.

About 300,000 duct feet of bituminized conduit has been used in the Lincoln Park system during the last two and one-half years. This was supplied by the American Conduit Company, of East Chicago, Ind. The extensions of the electrical system described in this article have been mapped out and executed under the supervision of E. C. Rutz, superintendent of the electrical department of the Lincoln Park system, who kindly supplied the data on which this article is based.

GENERAL VIEW OF CONDUIT CONSTRUCTION IN LINCOLN PARK.

Faults of the Tenderfoot Electrical Engineer.

An electrical engineer of one of the big branches of the New York Interborough Rapid Transit Company said the other day:

"In my employ there are a few boys who finished studies either in college or in the technical schools. When a boy is engaged he is told that in order to get along he must take to the ways of the shop. He is advised to adopt the conditions of an ordinary apprentice, begin his day's work on time, and look upon the foreman as his tutor. Very few follow this plan, with the result that the beginner becomes unpopular.

"It is almost the invariable plan of the tenderfoot engineer, when he seeks employment, to 'go in through the pipe'—that is, make some of his influential friends apply to the company in his behalf. When his application finally reaches my desk, it is backed up in such a way that I cannot do else but take him on. Then I pass him over to the foreman.

"Almost from the beginning the graduate takes on 'highfalutin' ways, which result in mechanical failure and cause him to leave the shop, unfinished.

"There are exceptions, though. A few years ago a boy came direct to me for work. He said he wanted to begin at the beginning. I told him that it was the rule of the shop that all applications be made to the foreman. He applied and caught on, and was put in the armature room. From the start he made good, and is now second in shop charge.

"If a boy has a desire to get on, it would be well for him to throw off false pride and begin as an ordinary mortal. Let him give the foreman and his workmates to understand that he means to be practical. This will help him immeasurably.

"A graduate should apply direct to the foreman for work, and make good after getting it, and should not quit the shop too soon in the belief that he is the finished article."

The *Journal of Electricity, Power and Gas*, states that during the past summer a number of electrical manufacturers employed a college professor to roam around the works to talk with the men, encourage them to ask questions, and explain in simple language the scientific principles underlying the work they were doing.

TO THE PACIFIC COAST AND BACK.

SOME FEATURES OF ENGINEERING INTEREST BY THE WAY.—THE NEW SIGNAL SYSTEMS OF THE SANTA FE.—ELECTRICAL DEVELOPMENT IN THE OIL FIELDS.—IRRIGATION IN THE SALT RIVER VALLEY, ARIZONA.—THE ROOSEVELT DAM AND HYDROELECTRIC DEVELOPMENT.

BY A. A. GRAY.

The writer had occasion recently to make a somewhat extended trip from Chicago to San Francisco and back, making several long detours in order to cover points of engineering interest, and it is thought that a brief chronicle of some of the interesting things discovered by the way might prove of some value to our readers.

So far as electrical engineering is concerned it is a fact that it would be hard to make a trip anywhere along the main arteries of travel without finding enough to keep the observer busy.

Leaving Chicago on the California Limited, the fine equipment operated by the Atchison, Topeka & Santa Fe, it is but a short time before one of the most interesting hydroelectric developments of the present time becomes a matter of absorbing interest. The transmission line of the Chicago Sanitary District comes into view, and from the observation platform a very good idea of the line construction and mechanical detail of this fine system can be made. Any of the Santa Fe officials can give the observing one a great deal of information respecting this hydroelectric project upon which millions of dollars have already been spent by the tax-payers of Cook County, Illinois. Beginning as a drainage canal proposition whereby the Chicago River, which heretofore had polluted the inshore waters of Lake Michigan, thereby contaminating the supply of drinking water served in Chicago, was changed in its direction of flow, a deep waterway and hydroelectric development of considerable magnitude have been constructed.

Near Joliet, Ill., is the site of a massive diversion dam and power house where the Sanitary District has installed an equipment of some 24,000 horsepower with sufficient generating capacity to supply a large number of nearby users in Chicago and other cities in Illinois, and it is found that in addition to the contract already let for municipal purposes there is a surplus for private customers for the Sanitary District current. The canal was begun September 3, 1892, and in January of 1900 the water of Lake Michigan was turned into it to find a new way to the ocean. As a matter of fact, it is expected that this project will form an important part of the lakes-to-the-gulf waterway if this enterprise is ever consummated. The length of the main channel is twenty-eight and one-half miles, the depth of water twenty-two feet, the width from 162 to 190 feet, and the total amount of excavation 43,397,904 cubic yards. The present capacity, which will be materially increased by river improvements, is about 300,000 second-feet and the total cost of the enterprise will approximate, it is believed, $60,000,000.

Practically every train on this division of the Santa Fe is electrically lighted, the majority of the equipment being of the axle-generator type. Automatic electric block signaling and electric interlocking is a feature that affords many opportunities for study, while in every town passed through there is the usual central-station equipment and even in the prairie and desert towns the electric sign is a prominent feature of the night illumination of the places adjacent to the railway.

On the main line going into the mountains, at La Junta, Albuquerque, Williams, Winslow, Barstow, Corcoran, and Bakersfield, the fine station buildings are in almost every case the subject of electric lighting, carefully worked out on modern illuminating engineering principles, and on gala nights these buildings, which are architecturally beautiful and typical of the racial characteristics of their location, are outlined and festooned with myriads of incandescent lamps.

To one with any imagination whatever it is a question whether the practical and utilitarian features of a trip such as this appeal more to the senses than the picturesqueness of the scenery en route. Certainly it will not be amiss to digress for a moment to mention the pueblos of Zuni, McCarthy and Laguna where the Indian in his native habiliment comes down to the train to sell his wares to the tourist, nor to dilate on the beauties of the arroya falling back for miles and miles until it merges into the foothills, the lower mountains holding the eye with an allure of color that makes one marvel at the variety of shadings thus naturally produced.

At Barstow there is a dividing point where the main line branches off to Los Angeles and the San Francisco division runs up through the Sierra Madre through Fresno, Corcoran and Bakersfield.

The trip from Barstow over the San Francisco division is one encompassing some of the most remarkable scenic wonders. Here the traveler gets an opportunity of examining fairly closely into extraordinary engineering achievements. The roadway abounds in short-radius curves, quick grades and cascades of tunnels.

Across the great Mojave desert it was our good fortune to witness a most beautiful mirage of a dry lake where it was hard to believe that we were not running up to the shore of a vast body of water, when in fact there was no trace of a stream for over 200 miles. Here also is an example of the yucca, of the family of the giant cactus, making a gallant struggle for life in the sunbaked desert, the cultivation of which, it is proposed, if successful, will create a natural resource out of this barren country of material for the production of pulp for the manufacture of printing paper.

Just north of Mojave station the railroad crosses the great aqueduct which the city of Los Angeles has built 250 miles into the mountains, bonding itself for $40,000,000, so that it may have a permanent water supply. A part of the project is a dry lake where all the shale entering into the construction has been secured and near to the railroad is the cement plant and industrial railway where this material of construction is produced for this gigantic development.

At Bakersfield a stop of three hours affords an opportunity to visit in an automobile the great oil district for which this country is famous. After a half hour's ride from the Bakersfield station the oil field is reached, where a forest of some 1,800 or 2,000 derricks make this field one of the most extraordinary producers of this country. The mechanical equipment of the Bakersfield oil district forms an interesting commentary upon the prospect of the utilization of electrical energy in the oil fields. But little progress has been made in this district in the utilization

of electric motors for any of the work, although in the Eastern oil fields and in fact in other California oil fields electric motors have demonstrated their superiority to steam-driven apparatus.

It is surprising to find long pipe lines from the central boiler station to the individual engines driving the pumping machinery, the steam piping being in many instances exposed to the atmosphere, where the conditions of condensation must be such as to render the steam service highly inefficient.

In contrast with the Bakersfield district are the Coalinga fields. Here two wells for the Kern Trading and Oil Company and one well for the Good Luck Oil Company have been driven, and these are being operated very economically by alternating-current, three-phase induction motors. One of the reasons why the adoption of electrical energy has been delayed is the great range of power required for the various operations of driving and pumping a well. This includes drilling, bailing, sanding, pulling the rods, and pumping, and in order to get a single electrical equipment with a range of power for the necessary requirements there has had to be worked out a very pretty set of winding problems. As a matter of fact, however, the Westinghouse Electric & Manufacturing Company has installed these equipments, and it is claimed that they are showing remarkable economy. It is estimated that the cost of pumping by electricity, figuring the current at one and one-half cents per kilowatt-hour, can be cut down to $1.50 per day, while pumping with steam engines works out to about $3.50 per day.

These oil fields can be easily reached by the transmission lines from several stations adjacent to the oil fields. Where oil is burned under steam boilers the fuel cost is, of course, very low, but the chemical composition of the water is such that the boilers must be overhauled at frequent intervals, sometimes every three months. In point of economy it appears that where natural gas can be secured as a complementary product of the oil field the gas engine will form a serious competitor of the electrical transmission system, but even where this is the case it would appear to be more economical to install batteries of gas engines driving electric generators and distribute the current economically to individual motors, thus eliminating the inefficiencies of long steam feeders and the great loss in mechanical friction which comes about with the rod and bar and wire drives of the present system. Then again, while the requirements of drilling, driving and pulling call for varying degrees of power the pumping load is practically a constant run for twenty-four hours per day and in point of load-factor is almost ideal.

San Francisco, Cal., in view of its population, has probably the most extensive branch-office electrical representation of any city in the country. The Pacific Coast States represent a vast manufacturing possibility, but at the present time conditions are not as good as could be wished. San Francisco is suffering from high labor costs and this is militating against the development of this city as a manufacturing community. With cheap power, however, and the building up of the communities farther back from the coast, and north and south from San Francisco, there is bound to be a wonderful development in the utilization of manufactured articles of every description, and with the growth of these communities the district is sure to develop large manufacturing interests.

Sixty-cycle alternating current appears to be the prevailing character of electrical distribution in and around San Francisco, while the great system of the Southern California Edison Company distributes at fifty cycles. Outside of electrical traction there appears to be very little direct current used, and the field here for alternating-current apparatus, particularly alternating-current controlling machinery, would seem to be excellent. There is plenty of enterprise in San Francisco, and the city has made remarkable strides in its rebuilding since the fire of 1906. The Pacific Coast Electrical Show, which was held from September 17 to September 24, demonstrated the great interest which the people of San Francisco and nearby cities are taking in electrical developments and the attendance at this exposition augurs well for the expanding of this market. An interesting feature of the Electrical Exposition was the complete representation of electrical vehicles. It will be remembered that the grades of the San Francisco streets are very severe and it was hardly to be expected that electric vehicles would gain much of a foothold in a city with such topographical characteristics. However, the sale of the electric vehicle is being pushed vigorously and with considerable success, while this type of motor vehicle is rapidly gaining favor in Sacramento, Oakland, Berkeley, and all of the delightful suburban cities adjacent to Los Angeles in Southern California.

Los Angeles is one of the most interesting cities in the far West. Thoroughly American and eastern in its environment, it seems destined to become one of the most important cities on the Pacific Coast. The Santa Fe is carrying out some very interesting signal work between Los Angeles and Garvanza, a nearby suburb. Here there are being installed about four miles of three-position, single-track automatic electric signals. The track circuit is supplied by three cells of gravity battery in multiple, while current for the operation of the signals is supplied by sixteen cells of battery wired in series. The batteries are located in concrete boxes alongside the track, these boxes being made moisture-proof with wooden covers sheathed with galvanized sheeting. An all-electric interlocking system is being installed at Fullerton. This will be a thirty-six-lever model, operating on 110 volts direct current. The equipment will include a 200-ampere-hour, type E-11 Electric Storage Battery accumulator set, charging through a General Electric mercury-arc rectifier. Current will be taken from the lines of the Southern California Edison Company at 2,200 volts, stepped down to 220 volts for the mercury-arc rectifier, and it is proposed to install here a motor-generator set which, when the equipment is complete, will supply current to the interlocking plant, the battery floating on the line.

What will be one of the most interesting signal installations in the country and constitute in some directions a radical departure in signaling practice will be the alternating-current automatic signaling system which the Santa Fe will shortly install. Plans are being perfected and the initial installation will probably be made on a forty-mile division between Cottonwood, Cal., and Daggett, Cal. Current will be generated and distributed at 6,600 volts, three-phase, and at each signal location the current will be transformed down to 110 volts for the signals and lights, and stepped down

from 110 volts to from ten to five volts for the track circuits. Mile blocks will be used and two-phase motors, taking current from Scott-connected transformers, will be utilized for operating the signals.

Phoenix, Ariz., may be reached from Los Angeles over the Santa Fe by way of Cadiz and Parker, where a new short line has been recently constructed. At Phoenix the offices and engineering headquarters of the Salt River project of the United States Reclamation Service are located. Here the Government is carrying out one of the greatest irrigation projects in the country and using the fall of the water to generate electrical energy for distribution to the surrounding territory.

The Salt River project purposes the irrigation of about 210,000 acres of reclaimable desert land, and in order to control the flow of the Salt River a massive dam has been built at Roosevelt, about sixty-five miles from Phoenix, Ariz. This dam is 280 feet high above bed rock, with a bottom length of 235 feet, and a length at the top of 1,080 feet. It is a masonry arch dam ranging in thickness from nearly 175 feet at the bottom to sixteen feet at the top where a highway has been provided for vehicles, concrete bridges carrying the roadway over the spillway to the sides of the canyon on both ends of the dam. Nearly 400,000 cubic yards of masonry have been placed in position to complete the dam, and the reservoir which it will form will create a lake of approximately 16,329 acres in area and backing up 1,400,000 acre-feet of water.

At the site of the dam the canyon is formed of cliffs rising almost perpendicularly, and the power house is built into the rock at the foot of the dam. Power for construction was secured through the agency of a power canal taken from the head waters about twenty miles from the location of the dam, and this canal forms a part of the permanent hydroelectric development of the project. At the present time at the Roosevelt power house there are three units in place, each of 900-kilowatts capacity, made by the General Electric Company, driven by thirty-six-inch S. Morgan Smith waterwheels. The power canal will be a constant-head equipment, while plans have already been formulated for the installation of several other units which will operate under varying heads as the level in the reservoir behind the dam is lowered during the dry seasons.

Power is generated at 2,200 volts. At the transfer station, which is built into the cliff a short distance from the power house, the current is stepped up to 45,000 volts for the transmission system. The three-phase transmission line is in duplicate from the transformer house to Phoenix, Ariz., with a sectionalizing station at Mesa, about eighteen miles from Phoenix, where several 10,000-volt circuits are taken off for service to the neighboring community and for distribution to substations where the voltage is stepped down to 220 volts for the driving of vertical induction motors for pumping.

The Government has built a wagon road from Mesa to Roosevelt, cutting this in many places out of the solid rock of the mountain. It is understood that something like $360,000 was expended upon the construction of this road. It is to be hoped, now that the construction at the dam is practically complete and the need for keeping up the road is not urgent, that the Government will not abandon it, but that steps will be taken to utilize to the fullest extent the wonderful natural beauties of this remarkable canyon. The scenic splendors of several of our Western canyons have been well advertised and it is only because the world of travel has not moved in this direction that there is not an overwhelming demand that the Government create out of this beautiful spot a national park. Here may be studied the Pimi and the Apache Indians, living in their wickiups, in primitive style, while not far distant from the dam site are some of the most picturesque remains of the habitation of the cliff dwellers that have yet been discovered. The country abounds in a variety of scenery ranging from pictures of utter desolation to crags and pinnacles of noble proportions, touched everywhere with colors such as only the eye of the artist can place, but which the soul of the most unimaginative can rejoice in. Already the irrigation project has been of great value to the valley. For a period of thirteen months there had been no rain, and the crops everywhere excepting those under the irrigating ditches were burned up. The water users are enthusiastic over the prospect of reclaiming the land, and it is believed that a ready market will be found for all the electrical energy that can be generated.

In addition to the development at the dam it is proposed to install a number of other stations at different points on the river where the fall will give a sufficient head to generate a considerable amount of power. About seventeen miles from Mesa at Granite Reef there is a diversion dam just below where the Verde River flows into the Salt River. A power station will be built near this point. In this way it is expected that the water of the Salt and Verde combined will be used in at least five power stations, and financial arrangements have already been made for the preparation of plans and the construction of machinery for three of these stations.

Creosoting of Telegraph and Telephone Poles.

The telegraph and telephones poles used in Great Britain are almost all of them imported from Russia, Sweden and Norway. It is therefore imperative to prolong the life of the poles as much as possible, and this is done by giving them a preservative treatment with creosote oil. About a dozen pole yards have been established at various points along the coast of the British Isles, where the poles are received, seasoned and stored ready for shipment to any point of the kingdom.

Electric Smelting in Norway.

The London *Times* states that an application is being made to the Norwegian Government for a concession for electric smelting on the Tromsö ironfields, which lie between Tromsdalen River and the Ramfjord, and on Tromsöen Island. It is proposed to utilize the Malangs Falls on the Maals Elv River for power purposes, and, if the concession is granted, to begin work in the spring with a plant capable of producing 700,000 tons of iron yearly. The ore is said to contain thirty-five per cent of iron.

Status of Inspectors in India.

In the proposed Indian Electricity Act of 1910, the Government of India provides that no electrical inspector shall be appointed unless he has had at least five years' practical experience in an electrical or mechanical engineering workshop or electric power station and after acquiring that experience shall have been engaged regularly for a period of not less than five years in the practice of electrical engineering.

Electrical Notes From Great Britain.

By Our British Correspondent.

The annual meeting of the Association of Mining Electrical Engineers which has just been held at Newcastle-on-Tyne was made the occasion for an interesting address by the president, William Maurice, on "What Ought a Mining Electrician to Know?" The Association is a new one, and during the short period of its existence has made excellent progress in the matter of membership, but it has been strongly criticized, and the criticism continues, in regard to the character of the membership. Some believe in the Association only while the colliery-electrician and electrical-engineer influence is in the ascendancy, and they contend that if you allow too strong a power in its affairs to colliery managers and to electrical manufacturers, the interests of the working electrician, in regard to personal status and to greater safety of installations, will be neglected, though the very *raison d'etre* of the Association was the improvement of the colliery electrician's position and the more efficient planning of colliery plants.

Others, Mr. Maurice among them, hold that the Association cannot possibly hope to achieve the various great objects it has in view unless it secures the co-operation of every section of the mining community that is interested in electrical application. There is a scheme on foot for the setting up of an Examinations Board which will settle a minimum standard of attainments and qualifications for candidates and the address referred to handled the subject of the extent of a mining electrician's knowledge in connection with this scheme. Mr. Maurice proceeded to lay down the lines which he believed to form a fair test of ability to take charge of a mining installation, and all the different sections of the Association will now settle down to a full discussion of the question. He said that owing to the wide variation of the actual requirements the matter was not easy to define. One colliery might have a six-kilowatt 100-volt generator and a few electric bells; another, an installation like that of a great city. It was essential that they should first find the bed-rock requirements, the nonpossession of which would undoubtedly disentitle a man to be called a mining engineer. For what purpose, he asked, was an electrical man engaged at a colliery? Was it not to maintain an electrical installation or part of one in an efficient working condition? What amount of theory and practice would suffice to that end? The indispensable qualifications to a six-kilowatt-plant electrician could not be taken as a basis for discussion. The object of the examination system which the Association is seeking to set up is to make a fair test of the fitness of a candidate to take charge of a colliery installation of average output. Can he do less than possess a working knowledge of the elementary electrical units? Can he take proper care of a generator if he knows nothing of electromagnetic induction to guard against fire and explosion risks of the special kinds peculiar to mining? He must know something of mine gases, coal dust and ventilation. If he would be sure that his motors are required to do only such work as they are fitted for, he must know what demand may be made on them in all the multifarious applications at a colliery. He must have some knowledge of sinking, pumping, winding, haulage and ventilating, etc., and the conditions favorable or unfavorable to the use of electricity for such applications. To enable him to keep coal cutters in safe working order he must understand something about methods of working coal. It might seem, at first blush, that the foregoing are in practice formidable requirements, but the president said that they really were nothing more than a wireman's training, plus a course in mining according to average County Council standard.

An important difficulty which arises in imposing any such test as is above outlined, concerns the many thoroughly reliable men who have been engaged in mining practice for many years, but who could not expect to pass the theoretical part of the examination because they are too old to do it with facility. It is thrown down for discussion whether to such a man there should be granted something in the nature of a certificate to show that he had been in charge of an average-sized colliery plant for an unbroken period—say five years.

In a number of places lately there has been fresh consideration given to the interesting question of the payment of bonuses to officials and workmen associated with electricity supply and tramway undertakings. Such a system has been recommended at Aberdeen, but after full discussion in the course of which it was shown that many disapproved of the payment of bonuses to men in municipal employment, the proposal was defeated. At Brighton where a system of bonus payments to collectors of electricity-supply accounts has been in vogue, there is a good deal of dissatisfaction with the results, and much friction is understood to have been caused both inside and outside the electrical department. The extent to which adverse feeling has risen will be gathered from the fact that the Council has, by nineteen votes to fourteen, referred back to committee a recommendation to continue the payments. While recognizing that any such department must be run on business lines, objectors hold that it is wrong policy to set on the track of consumers men who are paid by results for the prompt collection of moneys due. The general desire is rather in the direction of fostering harmonious relations between supply authority and consumer, but the effect of the bonus system at Brighton has led to this protest against the too early worrying for settlement that is an ever ready temptation for the energetic account collector who wants to enhance his immediate income whatever may be the ultimate indirect effects of his worrying on the department. Not many months ago one of the London boroughs (Marylebone) adopted a bonus scheme for the chief officials (five in all) of its electricity-supply department, a certain percentage of profits being payable after the profits reached a certain figure per annum in the same year that a specified reduction was made in price charged per unit, the control of price reductions remain in the hands of the Council. The result of this experiment will

be awaited with great interest both by other electricity-works engineers and by councils. The officials in question only stand to gain by the arrangement for the bonuses are payable in addition to the annual increments on salaries which are already fair for English electricity-supply practice.

In the tramway field a number of municipal authorities are working on bonus systems. A typical example may be quoted from the West Ham report which has just been issued. In this municipality there is a scheme in force under which merit stripes are awarded to motormen and conductors with over twelve months' service. At the end of each three-month period, each driver and conductor who during that time has been (1) free from suspension, (2) free from collision, accident or car damage for which he is blameworthy, (3) free from blameworthy complaints from passengers or public, (4) not more than twice late for duty, receives a lump sum bonus as follows: twelve cents per week with one merit stripe after one year's service, eighteen cents per week with two merit stripes, after two years; twenty-four cents per week with three stripes after three years. A star is worn for the following year by employees receiving all four of the bonus payments for the year. The conductors have a bonus of $1.20 payable at the end of the quarter to each man whose fare receipts are over the average in his particular group, and who has not been reported for bad time-keeping on the road. During the past year the payments to motormen under the scheme have been some $3,000 and to conductors $425.

West Ham is continuing the above system for another year.

The London County Council in order to keep pace with the requirements of London has continually to be looking ahead in regard to necessary new tramway lines, and as the result of an investigation of this kind the Highways Committee recommends a further twenty-two miles, part conduit and part overhead trolley, the cost including cars, equipments, substation works, and $1,250,000 for street improvements, being $4,450,000.

The National Electrical Manufacturers' Association has lately been passing through a re-organization process, and as a result British manufacturers are stated to be more in the ascendant among the management than they have ever been at any previous period of the Association's existence. New sectional departments have been appointed in which firms connected with like classes of manufacture will be able to "put their heads together" regarding questions concerning their particular interests. The Association has started out upon its big electrical exhibition scheme for Olympia, London, in September and October next year, and advance prospectuses have been issued.

ALBERT H. BRIDGE.

London, October 22, 1910.

The Cost of Traveling by Rail in Europe and North America.

The figures given below are taken from notes made by an experienced traveler, of amounts actually paid during a recent tour of several thousand miles on the European continent, in passing through countries having a total population of about 130 millions of people and traveling between sixteen cities with an aggregate population of about nine millions. A large number of the railways used are owned and operated by the respective governments.

In the journeyings in North America with which a comparison is made the country traversed has a population of about fifty millions and the routes are between sixteen cities having an aggregate population of a little less than ten millions.

In both instances the cost of traveling in the daytime only is reckoned. Sleeping-car fares in Europe are much higher than in America, but their consideration is outside the purpose of this article. Taking everything into consideration, a first-class ticket in Europe may be fairly compared, as to price and accommodations given, with a first-class ticket in America, plus a parlor-car seat.

The statement covers cost of traveling first-class for one person over a course of 2,154 miles in Europe, including eleven different journeys varying in length from thirty-eight miles to 497 miles, with a trunk of the average weight of 168 pounds. The total fare paid was $76.55, and the transportation by rail of the baggage, $19.42, making a total of $95.97. This is nearly four and a half cents a mile in all. The average speed of the trains was thirty and four-tenths miles per hour.

To compare this expense with the cost of traveling in North America a table has been made up of eleven different journeys varying in length from forty miles to 411 miles, over well known routes, the total distance being 2,211 miles. For this the total fares including the cost of parlor car seats figure up to $60.15, with a possible excess charge for baggage of $2.75, making a total of $62.90, or a trifle over two and eight-tenths cents per mile, the average speed being thirty-eight and six-tenths miles per hour.

Under the above conditions, the cost of railway traveling in Europe is over 55 per cent higher than in North America.

To state the matter differently: A passenger with a trunk in Europe would travel first-class 500 miles in sixteen hours and twenty-seven minutes at a cost of $22.25; while a passenger in North America with the same baggage would travel in a parlor car 500 miles in twelve hours and fifty-six minutes at a cost of $14.30.

A considerable part of the travel in Europe is in the second-class and third-class compartments. Second-class compartments may be compared with the ordinary first-class coach in America, and an examination of the second-class fares is therefore necessary to a fair consideration of the whole subject. Third-class accommodations, and consequently fares, have no parallel in North America, exclusive of emigrant trains, and need not be considered. The actual second-class fares on the eleven routes are the basis of the calculation. The cost of traveling 2,154 miles second class in Europe, at 30.4 miles per hour, with an average of 168 pounds of baggage is $69.26, or 3.21 cents per mile. The cost of traveling 2,154 miles first class in America, at 38.6 miles per hour, without parlor car seat, with an average of 168 pounds of baggage is $51.86, or 2.41 cents per mile.

The cost of traveling second class in Europe with only hand baggage is about the same as the cost of traveling first class in America with only hand baggage.

Various other comparisons may be made but they all show that under equal conditions the ordinary passenger fares in North America are considerably cheaper than in Europe, notwithstanding the much greater density of population in the latter.—*The Official Railway Guide.*

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

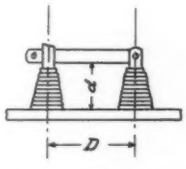
ELEMENTS OF POWER-STATION DESIGN.—XI.

SWITCHBOARD DESIGN.—II.

BY W. B. GUMP.

Disconnecting Switches.—The proper location and the spacing of disconnecting switches are matters demanding very careful attention, and cannot be neglected if successful operation is to follow. Fig. 1 gives general dimensions for voltages ranging from 2,300 to 80,000 volts.

Wherever possible the blades of disconnecting switches should swing away from the live terminal to open. That



Volts	D	d
2300	6"	3"
6600	7"	3
13,000	8"	4"
25,000	10"	6"
50,000	16	8
80,000	20"	12"

Note: Use insulators as given for Bus Compartments

FIG. 1.—SWITCH DATA.

is, the blade should be dead when open. This rule cannot always be followed, since disconnecting switches are employed to cut out oil switches or sections of busbars connected to live portions, and therefore full potential on the blade cannot be avoided. An illustration of this condition is shown in Fig. 2. In this case the switch blade *B* will have full bus potential with either connection to the blade if the line *C* is energized.

In placing a number of disconnecting switches next to each other due allowance must be made for the swing of the blades, and where they are side by side it is generally advisable to interpose soapstone barriers between, and of a width exceeding the length of the switch blade.

Size of Conductors.—In determining the size of conductors to be used in power-station wiring, due respect must be given to the question of overloads. This item is too frequently neglected, and more or less serious trouble follows. Conductors which are inclosed in ducts are doubly liable to give trouble, because of interference with radiation, due to insulation and to confinement in the duct itself. Increasing the size of conductor increases the carrying capacity, but decreases the rate of heat radiation. It often becomes expedient to circulate air through a duct system by artificial means, and thereby keep the temperature well below the danger point. Curves from tests made are shown in Fig. 3. It is clear from the inspection of these curves that inclosed conductors are decided restricted as to safe current capacity. For example, a maximum rise in temperature of thirty degrees centigrade above the surrounding air limits No. 000 cable in tile duct and concrete to 230 amperes, or fifty amperes less than when exposed to air. In other words this cable is reduced eighteen per cent by being inclosed, as compared to exposure to open air, or twenty-seven per cent compared to inclosure in sand. Therefore the cost of copper required

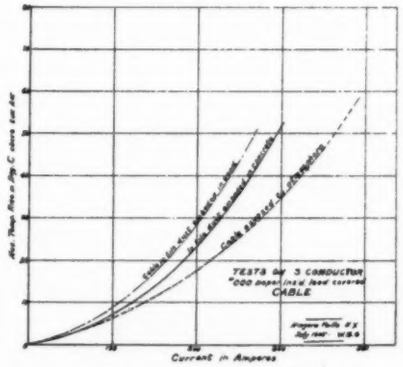


FIG. 3.—TEST CURVES.

for a given current is proportionately increased. The moral is that conductors should be exposed when other factors make such an arrangement practicable, as, for example, with busbars, and similar portions of the wiring.

From the above it is seen that on the one hand we have the extra cost of copper and insulation, and on the other, a reduction in space as compared to a barrier system. These qualities thus oppose each other, and the proper compromise must be determined for each particular set of conditions in hand.

The area of cross section of copper

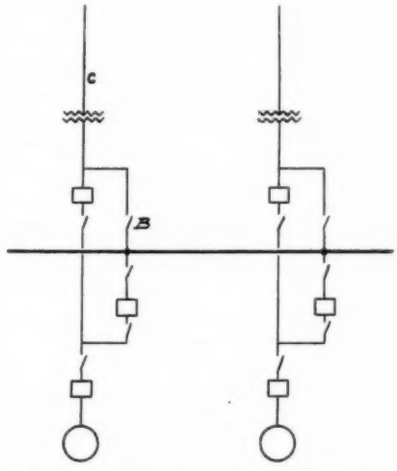


FIG. 2.—DISCONNECTING SWITCHES.

for busbars is given in the accompanying table. This table, it should be noted, was computed for a fifty-per-cent load-factor. For a load-factor of unity, the circular mils should be doubled. The values shown refer to bare

TABLE OF COPPER BUSBARS.

Amperes	Circular Mils	Cir. mils per amp.	Usual Dimensions
430	318,300	740	1 x ¼ in.
530	397,290	750	1¼ x ¼ in.
625	477,465	765	1½ x ¼ in.
725	556,400	780	1¾ x ¼ in.
1,035	954,930	9,200	2 x ⅜ in.
1,500	1,591,500	1,060	2½ x ⅜ in.

copper. Due allowance must be made (as previously shown) for inclosed conductors such as cables. Flat strips are always preferable to a square or round section, on account of heat radiation and also economy in space required for supporting.

Choice of Instruments.—One of the most vital issues in connection with the design of a switchboard is the question of choosing instruments. Modern

switchboard practice has evolved from very crude beginnings, when instruments for measuring electrical quantities were almost unknown, and the few in use were too far from accuracy to be classed as instruments even in name. The switchboard of the present day is fitted with instruments whose accuracy is of a high order, and as a consequence the measurements pertaining to plant economy are far more dependable than ever before.

In making a choice of instruments for the switchboard of a generating station the operating conditions to be met must be kept clearly in mind. Instruments for switchboard use may be classified under (*a*) indicating and (*b*) recording instruments. In small plants the only recording instruments in general use are wattmeters and voltmeters. In many large systems, recording ammeters are practicable.

The usual equipment of instruments for each generator panel in a three-phase system consists of (*a*) One voltmeter; (*b*) three ammeters; (*c*) one indicating wattmeter.

A frequency meter may be used for each generator, but one for each section of bus is sufficient if a suitable switch is provided as a means of connecting to any machine or group of machines operating in synchronism. If a straight vertical board is used, the synchronizer may be swung on a hinge at one end. On a long switchboard a central position above the board is to be preferred, having an illuminated dial.

The advantage of a power-factor meter is somewhat doubtful except in connection with synchronous motors, or motor-generators, in which case the question of field excitation is of extreme importance. Relative to line power-factor this instrument is of service, but its range for accurate values is limited and its adoption not particularly urgent in most cases.

Each feeder should be provided with an ammeter for each leg and a recording wattmeter. When feasible, the load on all feeders can be recorded on a totalizing panel which will give the total output of the plant. The latter arrangement is not applicable to large plants where the busses are divided, and the lighting is kept separate from the power load. It is clear that with the unit system the output must be divided between machines in such a way that totalizing is not only inconvenient, but is practically out of the question.

It is well to state here that single-phase instruments are apt to be more accurate than polyphase instruments. This is due primarily to unbalancing between phases. There is some question as to whether absolute accuracy is maintained with a polyphase meter, even on a perfectly balanced system, since such an instrument is necessarily more complicated in its action than a single-phase instrument. These facts notwithstanding, the use of polyphase instruments has a legitimate place, and their adoption is entirely practicable. A large factor responsible for the inaccuracy of alternating-current meters on high-tension circuits is directly chargeable to the current and potential transformers. It is well known that the relation between the primary and secondary is not a straight line. The instrument must therefore be calibrated for each degree, with the transformers to which it is to be connected. Due to aging, temperature changes, and other variable quantities the readings tend to deviate from the original calibration. The only remedy is recalibration. In order to facilitate this task it is advisable to equip the instrument stand with plug switches to which standards may be connected for calibrating. In this way the inconvenience of disconnecting and removing the switchboard instruments is eliminated.

It is well to note the importance of curve-drawing instruments. At the present time no power station can be complete without them. These instruments show the characteristics of a plant more effectively than any other means, and may be regarded as the chief item in the record covering power-station operation.

Control and Instrument Wiring.—It is of the highest importance to separate the control and instrument wiring from all high-tension wiring. The method of accomplishing this is to inclose all instrument wiring in iron pipe or fiber conduit which should be imbedded in concrete. The only possible source of trouble from high tension is then confined to the insulation of instrument transformers. Since the effects of grounds and short-circuits arising from contact between high-tension and instrument wiring are very disastrous, the practice of grounding secondary circuits is well founded.

It is advisable to separate wiring to potential transformers from that of current transformers, and to group the wiring for each unit. In this way any trouble occurring to a control or instrument duct will be confined to that unit, and cannot spread throughout the secondary system. It is important to note that in a large power station a central control system demands long leads running from instrument transformers. The leads connected to current transformers are normally of low potential, and their length is an item deserving careful consideration, since temperature changes are bound to alter the potential and influence the readings, unless properly compensated. The shorter these leads can be made, the smaller is the chance for error. Current transformers should therefore be installed as close to the instrument board as possible.

In systems where the neutral is to be grounded a current transformer is required for each leg of the circuit in order to actuate the relay from a ground on any line. It is not necessary in any case to use more than two potential transformers. The advantage of three potential transformers connected in delta would be that if one goes wrong the other two are still available for three-phase measurements.

In conclusion it is well to note that in a system whose neutral is grounded it often becomes advantageous to measure the current which flows to ground. For this purpose a current transformer and ammeter are required in the line connecting the neutral point and ground.

As to the type of instrument to be used, much depends upon the space available. Where bench-board control is used either the round pattern or the horizontal edgewise type is satisfactory. In large stations where there are a great many feeders and the space for a central control is limited, the vertical type of instrument becomes expedient. In order to have a view of all the instruments from one point, the instrument stand may be set to conform to a curve whose radius is a convenient distance between the center of the operating floor and the feeder instruments. A circular control and instrument board is not usually to be recommended when a straight board can be installed since the irregularity in the

system of wiring and the construction in general is apt to be inferior to a straight switchboard. This condition is more noticeable in planning for a large number of extensions. It is evident that a straight board will generally offer far better opportunities to extend without interfering with the existing construction than is the case with a circular board.

Exciter System.—It is important that the exciters, of which there should be at least two, are within easy reach of the operator. Where space and other factors are favorable the exciter switchboard should be placed on the main operating gallery. When this cannot be done, the next best arrangement is remote control operation, in which case the exciter board may be close to the exciter on the main floor. The capacity of each exciter should be ample for supplying current to all of the units. At least one exciter should be driven by a prime mover other than a motor, and as a rule motor-driven exciters are to be avoided entirely. It is often a great advantage to provide a storage battery in conjunction with the exciter system.

(To be continued.)

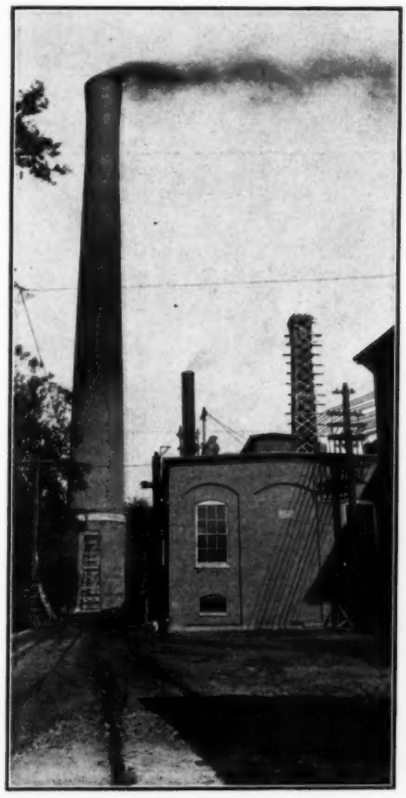
Electricity in New Mexico.

One of the most extensive systems of electrical transmission lines in the Southwest in connection with the agricultural industry is that of the Deming Electric Company, of Deming, N. M. It has extended its power lines from its central plant at Deming to many parts of the Mimbres Valley and many farmers are using the current to operate their irrigation pumping plants and for a variety of other purposes upon their land and in their homes. The motors installed by these farmers range in capacity from five to forty horsepower. It is not unusual for the barns and outbuildings and residences of this district to be lighted by electricity. The Deming Electric Company is adding constantly to its transmission system and expects to have double its present mileage of lines ready for operation in the valley by the time the farmers are ready to begin spring work. D.

A report has been received from Jarrolds Valley, W. Va., to the effect that the Seng Creek Coal Company will shortly proceed to equip its mines with electrically operated machinery.

Protecting a Tall Chimney from Lightning.

The Dwight Manufacturing Company, of Chicopee, Mass., has recently erected a new chimney to furnish draft for a boiler equipment of 7,000 horsepower capacity. This chimney will take the place of the present induced-draft apparatus. It is 250 feet high above the top of the foundation, has a twelve-foot diameter flue, and a concrete foundation bedded on rock. The total weight of the chimney and foundation is about 4,500 tons, the weight per square foot on the supporting rock being slightly less than three tons.



CHIMNEY AT PLANT OF DWIGHT MANUFACTURNG COMPANY.

The problem of lightning protection presented some very interesting features. Ten three-quarter-inch copper rods are screwed firmly into holes tapped in the cast-iron cap at equal distances around the top. This cap is made in two parts, one set on the external shell and the other on the internal shell, which extends twelve inches higher than the outer one.

The ground conductors are four in number and consist of one-eighth by one inch copper ribbons, spaced equidistant around the chimney. Each one of these is attached to the cast-iron cap by four half-inch composition tap bolts, the cap being filed smooth under each band and a two-inch expansion loop being provided between the inner and outer caps.

The conductors are attached to the brickwork by one-eighth by one inch copper clamps every four feet, which are nailed with two three-inch copper nails to composition plugs set in the bricks. The conductors are free to slip behind the clamps and a two-inch expansion loop is provided every 100 feet. Every thirty-six feet a one-sixteenth by two inch copper band extends entirely around the chimney and is connected to the vertical ribbons by two quarter-inch copper rivets, the joining edges being chamfered and tightly soldered. The joints in the bands and in the ribbons are made with four quarter-inch copper rivets, the edges being chamfered and soldered as above.

At the base, three of the copper ribbons are buried about twenty feet in the ground, the end of each being securely riveted and soldered to a No. 16 gauge copper plate measuring 2.5 by 5 feet, which is buried in a two-foot layer of charcoal or crushed coke about pea size. This will prevent any oxidation of the plate or ribbon and its consequent disintegration. The fourth conductor is led to a water main and soldered in two places to brass plugs screwed into separate lengths of pipe. For a distance of ten feet above the ground the brass ribbons are protected by a grooved plank securely spiked to the brickwork.

The chimney and the lightning protection system were designed and the erection supervised by Charles T. Main, of Boston, Mass.

A Chinese "Electric Park."

The Chinese city of Dairen has an electric street railway consisting of three miles of single track and five miles of double track, of standard gauge. In order to encourage a greater use of the cars, an "electric park" has been erected near the center of the town.

This modern park includes conservatories, menagerie, theater, bowling and shooting alleys, roller-skating rink, camels, etc.; in fact, all the accessories of a modern amusement park. A charge of two cents is made for admission.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

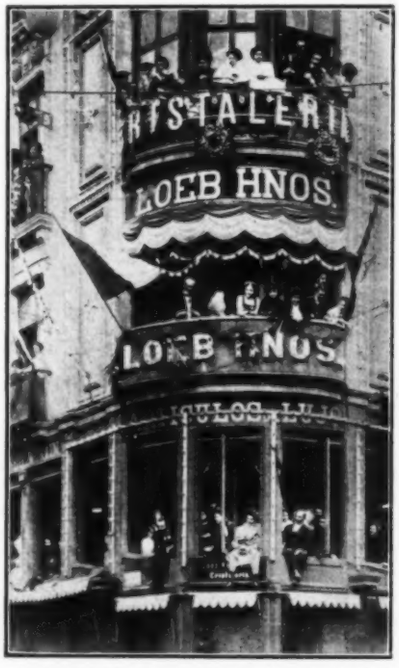
MEXICO'S CENTENNIAL ILLUMINATION.

BY W. D. HORNADAY.

One of the most attractive features of the elaborate celebration of the centennial anniversary of the independence of Mexico was the electrical illumination in the capital of that republic. On a less brilliant scale this electrical decorating scheme was carried out in all of the larger cities of the country. But it was in the City of Mexico that the surplus power of the great hydroelectric plant of the Mexican Light & Power Company made possible the use of the most extensive designs of illumination upon the exteriors of the various public and private buildings, upon the streets and in the parks and grounds. The grand illumination of the capital was a striking novelty to the visitors from other parts of that republic and was an unfailing subject of interest and favorable comment on the part of the Americans and other foreign visitors who participated in the holiday festivities. The centennial celebration occupied the whole month of September. The lamps and other fixtures are still in position and the illumination will be repeated in December on the occasion of the inauguration of President Porfirio Diaz and Vice-President Ramon Corral for another term of office of six years.

Perhaps the most important fact connected with the prodigality that was shown in the use of electricity in illuminating the city during the centennial celebration is the wonderful educational influence that it had in showing the business men the advantages of electric signs. Many of the merchants, situated upon the principal streets which were kept continually in a blaze of light during the thirty days that the festivities were in progress are now urging that the illuminating scheme be made a permanent thing. More orders for electric signs have been given during the last few weeks than ever.

The high cost of wood and coal for fuel was the prime incentive that led to the installation of the great hydroelectric plant at Necaxa and the construction of transmission lines to the City of Mexico by the Mexican Light & Power Company. Ever since this plant was established several years ago the City of Mexico has been one of the best illuminated cities upon the continent. When the plans for the centennial celebration were being arranged the Government placed an order for the installation of more than 125,000 incandescent lamps of various sizes. Other orders for private illumination came pouring in and the Company found that the installation of more than a quarter of a million of these lamps would be required. This would mean a huge extra load for the plant to carry, and in order to provide for it the Company was compelled to ask all private exhibitors to use the new five-watt, twelve-volt tungsten sign lamp. This request met with such a liberal response that 136,172 of these lamps were contracted for to burn during the entire month of September. In addition to these small units the government used 66,258 carbon-filament lamps of ten-candlepower each, 12,195 carbon-filament lamps of four candlepower each, 11,742 similar lamps of sixteen candlepower; 3,100 carbon lamps of two candlepower and sixty-eight of the large tungsten units of 150 and 250 watts each. This illumination was increased by the installation of 125 arc lamps, varying in size from four to twenty amperes.



ILLUMINATION OF BUSINESS BUILDING.

It has been the practice for several years to illuminate electrically the exterior of the National Palace and the towers of the great Cathedral on the occasions of President Diaz's birthday and the anniversary of the nation's independence, September 15 and 16 respectively. The illuminations of former years, however, paled into insignificance as compared with that of the recent centennial month. Upon the three towers of the Cathedral were installed 18,800 carbon-filament lamps, each of sixteen-candlepower. Rising to a height overlooking the whole city these towers were a blaze of light that could be seen from all parts of the capital. Diagonally across from the Cathedral is situated the National Palace, and upon this ancient and historic edifice, 8,900 carbon-filament lamps, each of ten-candlepower shone forth night after night. On another side of the Zocalo Plaza upon which the Cathedral and the National Palace front is the Municipal Palace. The latter building's outlines blazed forth with 6,000 carbon-filament ten-candlepower lamps. On the fourth side of the Plaza are great department-store buildings and these were illuminated on a scale of brilliancy never before witnessed in the Mexican capital. In all there were more than 68,000 separate incandescent lamps upon the buildings fronting the Plaza. In the Plaza were fifty twenty-ampere arc lamps which added to the brilliancy of the scene.

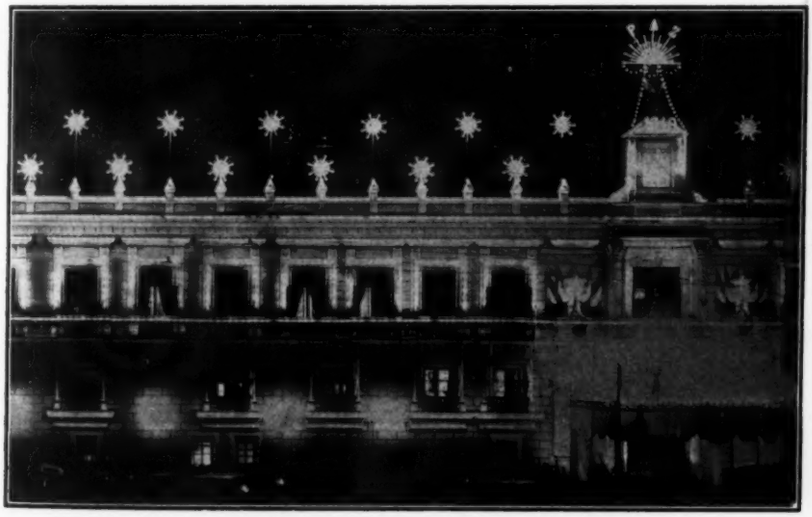
All over the business part of the city the private decorations were on a scale that attracted the attention of visitors. The private building of the Mexican Light & Power Company was illuminated with 7,163 colored incandescent lamps. A noticeable feature of this decoratve scheme on this building was an electric eagle in which 2,100 lamps were used.

TOWERS OF THE GRAND CATHEDRAL IN THE CITY OF MEXICO, ILLUMINATED DURING THE RECENT CENTENNIAL CELEBRATION.

Besides these building decorations the grounds of Chapultepec Castle, where President Diaz has his summer home, were illuminated with 20,000 lamps and an electric fountain of gigantic proportions played its myriad colored waters in an artificial lake in these grounds. The interior illumination of the National Palace was on a grand scale. In the ball room were 40,000 incandescent and 100 arc lamps.

All of the larger mercantile establishments, the hotels, the homes of the diplomatic representatives and many other private residences burned many extra lamps during the celebration.

For the first time in the history of the republic mercury-vapor arc lamps were given a trial. These lamps threw a brilliant light over the building of the government department of foreign relations.



ILLUMINATION OF THE NATIONAL PALACE.

The heaviest load of the power company was on the night of September 15 when the transmission lines brought 7,000 horsepower into the city from the hydroelectric plant at Necaxa. Not one pound of coal was used to generate this additional electrical energy. There was no interruption to the operation of the plant, not an accident occurred, not a man was injured. Everything went on as smoothly as if the extra business was an every day occurrence. It marked the dawning of a new era in electrical development of Mexico.

The effects of the extra illumination during the centennial month were so pleasing to many of the leading business men of the Mexican capital that they have decided to make the additional electrical installations permanent features of their respective buildings. While in many instances the construction and arrangement of the electric signs were hastily done these were not lacking in artistic attractiveness. The color effects seem to appeal particularly to the average Mexican and the signs composed of differently colored lamps never fail to attract the interest and attention of these people.

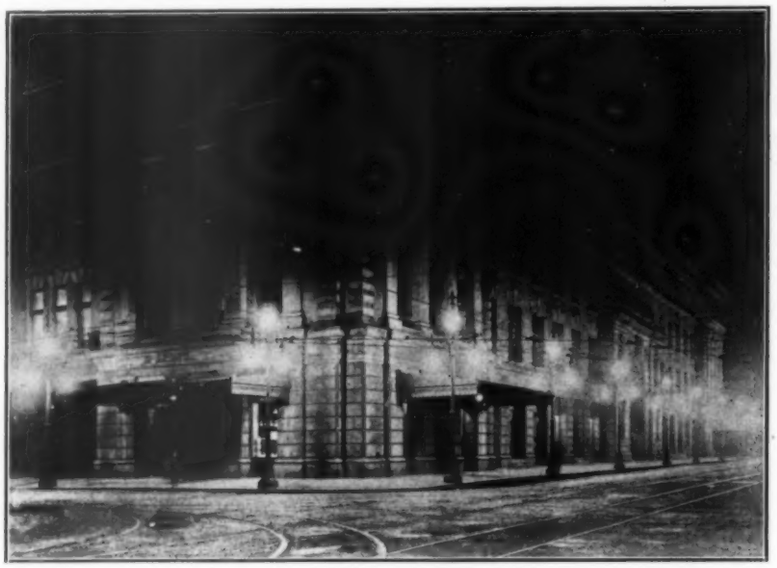
Ornamental Arc Lighting at Toledo and Milwaukee.

The movement for the ornamental lighting of the streets in our business districts has received a great impetus in the last two years through the now quite common use of tungsten clusters. That arc lamps are also entirely suitable for such ornamental lighting has been shown by their extensive use for this purpose in at least three cities, Toledo, O., St. Louis, Mo., and Philadelphia, Pa. The latter two installations have been described in numerous articles within the past year in this and other journals.

The installation at Toledo was begun nearly three years ago and has been extended from time to time, so that now it covers several blocks on twelve streets in the downtown district and many other leading streets throughout the city and comprises a total of close to 2,500 four-ampere General Electric luminous-arc lamps. These lamps illuminate an area of forty-nine square miles. The merchants are so cognizant of the benefits to them of well-lighted streets that they have formed themselves into "locality societies" and through these are rapidly extending the arc-lighted zone.

Each of the standards used in the Toledo ornamental lighting carries two lamps and is of such a height that the lamps hang nineteen feet above the street. The bases are of ornamental design and extend approximately nine feet above the curb. The

two lamp brackets surmounting the post proper, which is made of four-inch extra heavy pipe, are of very graceful scroll design. The accompanying diagram shows the details of



ORNAMENTAL ARC LIGHTING ABOUT THE PUBLIC SERVICE BUILDING, MILWAUKEE, WIS.

the lamp-post, manhole and conduit construction.

The cost of trimming is exceptionally low, owing to the long life of the electrodes. The life of the lower (magnetite) electrode is approximately 170

DAY VIEW OF ORNAMENTAL ARC LIGHTING ON BUSINESS STREETS, TOLEDO, OHIO.

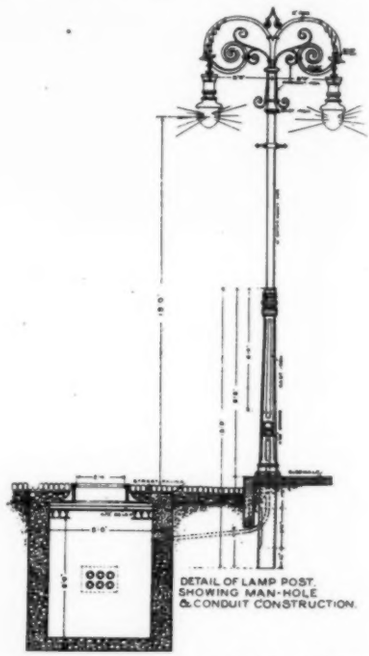
hours, while the upper (copper) electrode has to be renewed only every two years. It has not been found necessary to provide a method of lowering the lamps for trimming. One man can take care of about 250 lamps.

The mercury-arc rectifier sets used to operate these lighting circuits give wonderfully good service. The rectifier tubes have given an average life of 890 hours. There are an average of fifty lamps in series on each circuit.

W. E. Richards, of the Toledo Railways and Light Company, in his paper presented before the recent convention of the Association of Edison Illuminating Companies, held at Frontenac, Thousand Islands, stated that some engineers believed that the idea of using arc lamps for display lighting would detract attention from the electric signs installed along the streets, but this fear has proved to be ungrounded in the case of luminous-arc-lamp installations, as practically all of the light emitted falls in the lower hemisphere up to ten degrees below the horizontal.

Arc lamps mounted on ornamental poles make an excellent combination, not alone on account of their economical operation, but because of their brilliancy at night and artistic appearance in the daytime. Display lighting of this character has a distinct advertising value with a direct financial return.

There is an interesting installation of display lighting by arc lamps in Milwaukee, Wis. The Public Service Building, which is occupied entirely by the Milwaukee Electric Railway and Light Company, and covers one



DETAIL OF ARC-LAMP POST, TOLEDO, OHIO.

square block, is surrounded entirely by a large number of General Electric inclosed arc lamps on ornamental poles. The poles are spaced very closely and three lamps are hung on each one. The type of pole used is of similar design to the ones that have been adopted in the lighting of Broadway, St. Louis, the only difference being a slight change in the ornamental base.

The night photograph reproduced herewith discloses a wonderfully brilliant illumination in which there is an absence of shadows. This lighting makes the building conspicuously noticeable from a great distance and has created very favorable notice in Milwaukee, both from citizens and visitors.

ELECTRICAL Advertising and Selling

CENTRAL-STATION SERVICE.

BY H. R. LEONARD.

Whether people support or antagonize a public service corporation depends on the quality and efficiency of its service. The word service includes all the acts by which the people receive the benefit of the large-scale production made possible by the corporation. Poor service means general dissatisfaction, followed by political troubles and public prejudice, which years of excellent management may not be able to overcome. On the other hand, good service, while not productive of such immediate results, establishes a firm bed-rock confidence, by which the prosperity of the undertaking is assured.

In the following paragraphs, I shall consider service from the commercial standpoint of a central station. I do not aim to discuss methods of selling electricity, but merely to point out certain practices, and to offer suggestions which make for good will, efficiency, and satisfactory service.

The progress of a central station is dependent on the number of prospective customers which are added to its lines. It naturally follows that new buildings are the most important field of endeavor, and that toward this class every effort should be made to give the best service which the state of the art can offer. To accomplish results the trained solicitor should co-operate with the owner and architect. The solicitor has the technical knowledge of light intensities, and general good practice, but knows nothing of the effects which the owner and architect intend to produce. The owner probably has no technical training, and knows only in a vague way what he desires. However it is the owner who makes the decision. Very few architects have any exact information as regards electrical arrangements and economies, but know what artistic and constructive effect they desire to produce. It is evident that these three must discuss the problem of properly installing electrical service in a building. Anyone of them alone will obtain unsatisfactory results. By this combination various economies may be affected, satisfactory lighting may be produced with a minimum consumption of current; switches may be located most conveniently, encouraging economy in use; future developments and physical effects may receive proper attention, and the architectural values be greatly increased.

The intensive cultivation of existing prospects is perhaps just as important a factor in the success of a central station, as the work on new buildings and the service rendered this class of business should be very carefully planned. Usually people, whose homes are wired and located favorably for connections, and who refuse to use the electric power, either are sadly misinformed about its value and cost, or hold some ancient grudge against the company. Tactful and persistent work by the solicitor can make these people satisfied users.

In the case of buildings not wired, and using some other method of illumination, it is a very difficult proposition to cause a change unless interior alterations are contemplated. Careful and considerate attention must be given this competitive proposition. The aim of the solicitor should not be to displace the old methods by electricity at any cost, but to do so only when he is certain that the customer will receive proper service. Too many times has gas been displaced by a drop cord equipped with a bare lamp. A policy which allows an installation to exist which falls below the standard is not giving good service nor using progressive business methods. It is self-evident that the installation of antique apparatus where efficient equipment is available, is retrogression of the worst sort, and should be absolutely avoided. Electrical contractors should aid the solicitor very materially in this sort of a campaign.

In all dealings between the solicitor and the consumer absolute frankness is imperative. Estimates of the cost of current should not be avoided, but given freely and substantiated by comparison. No promises should be made which cannot be fulfilled with exactness. The policies of the company are not secrets to be carried by the employees, but should be public property. The sooner the people become educated to the ideals and policies of the company, the quicker good service will be recognized and appreciated with a resulting increase in business and plant efficiency. Of course all these suggestions are very apparent truths, but very often they are forgotten or neglected with very unsatisfactory results.

When the public deals with the company through the office, the same general principles should be followed Whether paying bills, making complaints, signing applications, or asking for general information, it should receive every courtesy and attention from the employees. In receiving applications for connections, the clerk must use considerable discrimination and varied resources in obtaining information. The more accurate and complete it is, the sooner the connection will be made. Questions of credit should be handled very delicately with the burden of proof on the company. That is to say a man's credit should be considered good, until it is proven otherwise.

The system of handling applications should be designed to minimize the interval between the filing of the contract, and the selling of the meters. In many cases, however, the internal machinery may be most efficient, but some outside neglect traceable to the owner or contractor, will cause a serious delay if the company does not take the initiative to prevent it. Delays are usually caused by lack of city inspection; trouble with a customer's service location; or the necessity of an estimate of cost before extending the lines. Records of all these are kept in the office, and when any of them occur, the

customer should be notified immediately, so that the delay will not be perpetual.

Even after all requirements are satisfied, and orders have been issued to the line crew and meter department, the obligations of the company are by no means ended. In the event of wrong instructions on the work orders, the crew should be taught to connect the customers temporarily until the mistakes can be remedied.

The meter department often finds a house closed when it tries to set a meter. As soon as the customer begins to get anxious to have light, he comes to the office and receives the information that the house was locked at the time when the meter man called. Here, as in every other case of delay, he should be notified immediately of the cause. These few examples are by no means exhaustive of the possibilities, but merely try to show that good service enters into every transaction.

After the lights have been installed the solicitor in whose territory the building is located, should inspect the lighting arrangement, and see that the lights have been placed as originally planned. This detail is often overlooked, but nevertheless is all important. He may find tungsten lamps in fixtures where the longest life possible would be about two days, or small candlepowers where large ones are necessary, and so on. The lasting impression that a consumer receives from an electric installation depends on the quality of his own. In central stations having the policy of periodic lamp renewals, and customers inspection, this phase of service is, of course, excellently cared for.

Throughout all these suggestions there is one principle which deserves particular emphasis. That is the principle of follow through. In any business or sport the man who approximates this principle most closely will be the most successful man. Ideals may be impractical, but progress would stagnate without them. Until central stations use the policies of competitive business houses, they will be a long way from efficiency and good service.

Belfast Corporation Electrical Show.

The municipality of Belfast, Ireland, will hold an exhibition of electric heating, cooking, lighting and power appliances from January 9 to 21 next.

The Borrowing of Telephone Service.

Those of us who live in big cities have some idea of the extent to which our neighbors sometimes impose upon our good nature in borrowing the use of our telephone equipment. The abuse of this habit in the city, however, is slight compared with the extent to which it is employed in the rural districts. The Kellogg Switchboard and Supply Company, Chicago, Ill., has struck upon a happy idea in its method of publicity to reduce this practice of borrowing to a minimum. The accompanying illustration is a reproduction of a cartoon prepared for this company. The sketch is printed on eight-by-eleven-inch stock as a wall hanger and will be sent by request to telephone men who are interested.

THE KELLOGG CARTOON ON TELEPHONE BORROWING.

A Book of Testimonials.

The Citizens Light, Heat & Power Company, Montgomery, Ala., is distributing a booklet containing expressions from customers regarding the service of the Company. As a preface to these testimonials there is given a brief history of the Company and a few arguments as to the value of uniform and reliable service.

New Display Rooms in St. Louis.

The Union Electric Light & Power Company, St. Louis, Mo., has recently opened a branch office on the west side of the city and in addition to its functions as a branch office there will be maintained a display room where the various applications of electricity in the home will be demonstrated.

The Company is also making elaborate preparations for a comprehensive display room in its new building, which, it is expected, will be ready for occupancy about December 1, 1910.

A New Central-Station Publication.

The Toronto Electric Light Company's section of the National Electric Light Association has, in the interest of the employees of the Company, commenced the publication of a new company-section bulletin. The publication will in the future be issued monthly.

In St. Paul's Cathedral, Calcutta, India, 36-candlepower metallic-filament lamps have been substituted for the 32-candlepower carbon incandescents formerly used. The increase in illumination is 12.5 per cent and the decrease in current consumption 58 per cent.

TELEPHONY—TELEGRAPHY, and WIRELESS.

TOLL-LINE LOCATION.

BY H. D. STEELE.

The adoption of the telephone for long-distance talking, and the constantly increasing use by the general public of this method of transmitting messages, has forced the telephone companies to face a growing demand for high-class service. To give this service the most modern equipment is necessary, together with sufficient capacity to handle all business without unnecessary delay.

The development of toll business since the beginning of the last decade has been far beyond the calculations of even the most sanguine, and plants installed then, although at that time amply sufficient in capacity and modern in construction, are now to a great extent obsolete and quite congested. But these plants are still, physically, in good condition, having been in use little more than half their possible lifetime. It thus becomes necessary for active companies either to build entirely new lines or so to reconstruct the present ones as to make them adequate to meet the new conditions of a traffic whose development will undoubtedly be much greater, proportionately, in the future than it has been in the past, and which should be taken care of by the new lines during their natural life.

One of the primary conditions necessary for good toll service is a clear, quiet line, and the governing factors in this condition are the location and construction of the line itself. Into the location alone a great many important factors enter, and a few suggestions as to methods of securing a good location are here offered. These methods will apply to either the relocation of an existing line or the location of a new one. Many of the existing lines have been built with little judgment or thought for future conditions and development.

Main lines should be given particular care in their location, as they are the principal arteries of the system. Branches will be built from these in time and will take care of themselves.

The nearer a toll line is to being straight, both horizontally and vertically, the closer it is to the ideal; but better far with the vertical than the horizontal angles.

Thus, the first factor in location is alinement. In the past it has been customary in many places when building toll lines to disregard entirely the value of good alinement and to follow closely the windings of some public highway, on the theory that the latter afforded a cheap right of way and an easy means of clearing trouble. But the time is at hand when heavy toll lines must be taken off of public roads and built across country, between governing points, on private right of way. When lines are built light and follow winding roads the initial expense of construction may be lighter, but when in time the line capacity must be increased, the extra expense of strengthening and straightening, the higher costs of rights of way, materials, and possibly labor, will far outrun the first cost of a well-located and well-constructed line.

A great many questions have to be decided before an approximate route can be chosen, and a field man sent out to investigate it. And it is advisable to have the ground thoroughly gone over and reported on by an experienced field man before a survey party is sent out or a stake driven. One bad piece of location will lower the standard of the whole line.

Before a map can be prepared on which the investigation and report is to be based, it must be decided what points are to be touched by the main line itself or by branches, the class of line to be built, and the probable development of traffic at each point during the natural life of the line. These features being decided, a general, but correct, map of the country adjacent to the proposed route should be prepared. This should show all public and private roads, railroads, water courses and property lines, and have attached to it plats on a large scale of all towns and subdivisions likely to be crossed by the line. Plenty of detail should appear on the general map. Names of highways, railroads, towns, streams and property owners are all necessary for location purposes, and are guides both in the office and the field.

The brunt of the work and the responsibility for the choice of location falls naturally upon the field man, and he should be a man of quick, clear judgment and able to balance fairly the respective merits of alternative routes. He should make copious notes during his preliminary reconnaissance so that he can make an intelligent report.

There are questions that arise, however, that must be decided by those in higher authority, and in which the field man can have pratically no voice when his report is submitted. The purchase of rights of way, and the use of the rights of way of other companies or individuals, are causes that may materially modify the field man's recommendation. These factors can be considered and decided upon only by officials of the company.

The right-of-way department can determine the probability of securing, and the approximate cost of any land rights to be considered, and these items should be balanced against the cost and maintenance of a larger and crookeder line on some public road. However, the benefit of any doubt in these comparisons of cost should be thrown in favor of the private right of way against the use of public roads where trees and power lines are liable to be sources of trouble.

The final location of the line having been decided upon, an approximate preliminary estimate can be made of the cost of the line. If this proves satis-

factory the line can be projected on the general map, and the right-of-way department proceed to secure rights of way. If any changes in the projected location are necessitated because of difficulty in securing rights of way, these changes can be made directly on the map. Or should any property owner demand a plat showing the position of poles and fixtures on his land, the field man can, at small expense, make a sketch survey to secure the necessary data.

Next in importance to the general location of the line is the location of each pole or fixture. Generally speaking, specifications give only the most superficial instructions for staking out toll lines, such as length of spans, height of poles for clearing crossings and obstacles, distance of anchors from poles, clearance for guys, etc. Even these instructions are very general and must be modified to meet existing conditions. After it is found either inadvisable or impossible to follow the letter of the specifications, so up to a certain point the field man should be guided in details more by his own judgment.

The stakes used for marking the positions of poles, stubs and anchors should be of pine or redwood, 1 by 2 by 16 inches, surfaced on two sides and sharpened. The upper eight inches of each stake should be painted with one heavy coat of good white paint. This makes the stake easier to find, and also forms a good ground to mark on. All stakes should be driven firmly into the ground—eight or ten inches when possible—and plainly numbered or named, anchor and stub stakes marked "anchor" and "stub" respectively, and all laid out with instrument and tape.

Full and careful field notes should be kept so that the line may later be platted in detail, showing the location of all stakes, whether on public or private land.

Before staking on public highways it is advisable to consult the district supervisor or the county surveyor as to the distance out from the property lines that the stakes should be set, as side ditches and foot paths must not be obstructed by setting poles in them.

All angle points should be established by driving a 2 by 2 by 12-inch stake flush with the ground, and guarded by a marker.

The stakes should be numbered consecutively, beginning with "1" at the first stake, and the numbers marked on the side facing the initial point. On the other side should be marked the length of the pole to be set at that point. The number and length of pole should be marked before the stake is driven, when the line is over smoothly rolling or level ground; but when surface changes are abrupt, levels should be run over the line, an elevation taken at each stake, and a profile made. On this profile a grade-line can be projected, the length of each pole calculated, and this length marked on the corresponding stake. By following this method a good grade can be secured even on very rough ground with a minimum of long poles.

When staking through private land the corners of property lines crossed by the survey should be tied in so that a plat of each individual right of way can be made showing the location of all poles and fixtures.

With regard to the grading of a toll line opinions vary among telephone men, many going to either one extreme or the other. But the grading even more than the alinement, should often be sacrificed, especially in very rough country, to secure a less expensive construction. Changes of grade should not be abrupt enough to cause danger of pole-pulling or distortion of arms or pins, but should let the wires run in easy vertical curves. When a gulch with steep sides is crossed it is advisable to put in a long span with either clear wires or sets of swinging arms. Whatever form of construction may be officially advised in these cases, it should be staked out by the field man according to specifications. Particular note should be made by the field man of any necessary special construction, such as side-arms, high river or railroad crossings, and screens for power-line crossings.

When the line is a cross-country one all roads, public or private, approaching or crossing the line should be sketched in the field notes, as these data will undoubtedly be of use later in the construction work for the distribution of material.

In its specifications for toll lines the American Telephone & Telegraph Company gives tables showing the length of spans to be placed next to single-pole corners when the "pull" is known. This is an awkward table for the field man's use, as it necessitates the finding of the "pull" to correspond with a certain span by experimentation, or trial and error methods. The field man can make a table for his own use by taking the span and its corresponding pull from the specifications, and applying the following formula:

$$\frac{\text{pull}}{\text{span}} = \text{sine} \frac{1}{2} \text{deflection angle}$$

The deflection angle is the exterior angle formed by one tangent with the other tangent produced beyond their point of intersection.

The writer's experience in telephony, as well as other branches of engineering, has satisfied him that in crossing deep, rough gulches the long-span special-construction method is better than setting poles on short spans down one side and up the other, and he would be glad to see this question brought up and fully discussed by telephone engineers.

A word of advice to the field man and his party will not be out of place here. These men should remember that the public judges a company by the behavior of its employes. The surveyor and his crew are often the pioneers of the toll line, and the impression they leave in the minds of those with whom they come in contact may be thorns or roses in the path of the right-of-way and construction men who follow them. Property owners or tenants should always be asked for permission to cut out or stake a line over their land before any work is done; and care should be taken that no material damage is done in any case. Where permission to cross property is absolutely refused, the field man can continue his line over the property by triangulation, or around it by traverse, until the trouble can be adjusted and permission secured. In any case no one, if possible, should be antagonized, for one disgruntled property owner may turn a whole community and cause a great deal of trouble and expense.

Texas Independent Telephone Association.

More than 600 independent telephone companies were represented at the annual meeting of the Independent Telephone Association of Texas which was held at Dallas, toward the end of October.

This was the second of the annual meetings of that Association.

TELEPHONE AND OTHER ELECTRIC RATE-MAKING.

BY BENJAMIN BAKER.

The present telephone rate situation in Boston, where the Massachusetts Highway Commission has recommended, and the telephone company has accepted, a readjustment of the city and suburban rates, is of much more than local interest. The Commission has adopted the principles laid down by its chief technical expert, Prof. Dugald C. Jackson, of allocating plant investment and running and fixed cost among classes of subscribers, and making the rates charged to each class by the company pay all these charges for each class. This principle has long been familiar in the sliding scales of electric service companies; but its application to telephone companies, and the working of it out under public authority for a concrete situation, was first done in a thoroughgoing way in Chicago, by the Commission headed by Professor Jackson.

Telephone companies have readily admitted the patent fact that their expansion has been so rapid, and the changes in the art have involved so much scrapping of plant and readjustment of system, that tradition and "experience" have been the main guides in the making of rate schedules. The experience of the Chicago Telephone Company under the system of accounting devised by the Jackson Commission appears to have shown the practical value of that system in disclosing just what classes of service and what rates were profitable to the company, and what unprofitable. Thus the Chicago flat rate for business telephones was shown to be causing a loss to the company from the excessive use of flat-rate lines that is the common experience everywhere. The nickel, four-party residence lines were also causing a loss, though the deficit for this class was largely due to the course of the company in assuming the cost of one removal per year for each subscriber demanding it.

The fact that the new Boston rates will cut the gross income of the company by something like $400,000 is not the most widely significant thing about the pending readjustment. More important is the introduction into Massachusetts practice of a principle of differential rates that the State Gas and Electric Light Commission has refused to consider in its dealing with electric light and power companies. Most important, perhaps, will be the effect of this example on the practice in other states, New York for instance, where the regulation of telephone rates by state authority is either new or wholly untried.

The question at issue is of great practical, and, in a certain proper sense of the word, political, consequence to all public-service companies dealing with electricity. It is apparent that rate regulation by public authority will soon be much more extensive and rigid than it now is. Stable and successful companies object less to the fact of regulation, in itself, than to regulation based on inadequate, or even mischievous, theories. It rests a good deal with the companies themselves, just now, whether future regulation in some directions shall be sound or the reverse. The principle of differential rates for telephone service as represented by Professor Jackson's reports, and in the practice of the Wisconsin Railroad Commission, appears to be getting pretty well established. But electric light and power differentials are still in a highly unsatisfactory state from a point of view that is likely to be increasingly powerful in the rate regulating commissions. The Massachusetts Gas and Electric Light Commission has discarded the differential idea on the ground that the differentials involved too many assumptions that could not be verified. It has looked at the investment, the costs and expenses of a company, and if the net income of the company, from all its business, has seemed too liberal, the Commission has reduced rates.

This attitude is associated with a view on the part of the Massachusetts Commission that is challenged and contradicted by the theory that each class of customers should pay its own costs and running expenses and interest on the plant investment devoted to its service; and that a public-service company should not accept any customers at rates which fail to realize a profit on the service given to those customers. The Massachusetts Electric Light Commission, on the contrary, holds that an electric power company acts to the advantage of its smaller customers in accepting large customers whose rates barely cover their service costs, and make little or no return in the way of interest on the plant investment by which they are served. This is the general position of the managers of the companies. But the Massachusetts Commission's position involves it in a contradiction. It rejects differentials on the ground that the elements on which they are based cannot be reliably shown by the accounting systems; yet its acceptance of the large-customer theory is at least in the main a matter of assumption, for which it would have to seek verification in the very accounting which it has already rejected as inadequate.

For electric service companies there is a serious and difficult task in the devising of differentials that shall pay proper regard to the matters of cost involved in the relation of each customer's use of current to the peak load. The peak is responsible for a large part of the investment in generating plant —a part used for so small a part of the day that the rates for its use may justly be made higher than the rates for the part or proportion of the plant that is in substantially constant use. On this theory, a short-hour customer taking his current on the peak should be charged a higher rate than a short-hour customer taking current in hours well off the peak. A twenty-hour customer who covered the peak should have a somewhat higher rate than a twenty-four-hour customer. The matter of investment for different classes of customers will also stand further study.

Two somewhat antagonistic ideas appear in the discussion of the claims of large and small customers for current —ideas which are more or less "moral" in character, and which tend to make more difficult the task of a scientific apportionment of costs and charges. One idea is that a public-service company should not be allowed to exercise the discretion that would always be conceded to a private company if that discretion involves "wholesale" rates that do not fully pay the running costs and fixed charges plus profits which might be chargeable to the part of the plant investment involved. Arguments to the contrary will come automatically to the mind of the operating official. This, however, is not the place to discuss the principle. The important point is that such business discretion, even though it be sound business judgment, easily appears as a discrimination between classes of custom-

ers for which there is the certainty of less and less tolerance on the part of the public.

On the other hand, there is a clearly marked disposition to insist that the small user, who cannot generate his own current, and must therefore buy it from the company, should receive everything that is economically possible in the way of favorable rates as against the large user who is assumed to be able to generate his own power in case of need. This tendency, again, is the expression of an idea of public policy that is only in appearance opposed to the disapproval of the extreme application of wholesale rates. It is properly conceived that the public interest is served by the widest possible use of electric power, just as by the widest possible use of the telephone. From this point of view, therefore, the public utility company has something of a missionary function in extending its service to the greatest possible number of customers; and to further this work the most rigid regulator is inclined to relax his theories in order to favor the small consumer.

It must be admitted that at present the small consumer gets in his bills for energy the benefit of the unfavorable doubt. The "readiness-to-serve" investment for the small consumer of energy is higher in proportion to his use of current than is the similar investment for the large taker, and on all business principles the small taker should be compelled to carry his own proper loading of investment. But here public, and perhaps company, policy may step in to point out that the use of current by small consumers is gravely restricted by this differential treatment. It is plain enough that the wide use of electricity for family cooking is at present impossible because of the cost. To the operating man, at least, it is also plain that the distribution of current for such service is costly, and that the expense of double metering for different uses of current involves an expense at present prohibitive. It may be, however, a not unreasonable guess that the attempt will be made by public authority to solve this question that the companies have not yet solved. The suggestion the facts seem to offer to the companies is that regulation is coming; that for the best interests of all concerned it ought to be scientific regulation; and finally, that the companies themselves, which have the widest knowledge both of the accounting facts and the technical requirements, are the proper agencies to construct a scientific and satisfactory theory of rates. Plainly, rates will be regulated. In certain directions the results of present theories are unsatisfactory. The immediate question, therefore, is, Who shall determine the new theory? The companies themselves would seem to be best qualified for the task.

Telephones for Dispatching Trains in the Far West.

The telephone method of dispatching trains has lately been adopted on the Shasta Division of the Southern Pacific Railroad, where telephone circuits have been installed on over 291 miles of road.

The new method is being used over a 206-mile section of main line between Ashland, Ore., and Red Bluff, Cal., and a branch of ninety-five miles from Weed, Cal., to Klamath Falls, Ore. The dispatcher is located at Dunsmuir, Cal., which is ninety-eight miles from Red Bluff, the southern terminal of the circuit. There are twenty-five stations on the circuit.

This entire circuit is composed of especially drawn 300-pound copper wire, metallic circuit. This telephone line goes through a mountainous region, and wire of extreme weight has been selected, not alone for conductivity but for tensile strength as well. This circuit during sixteen hours out of twenty-four is cut into two sections and during the third shift the entire circuit is operated by one dispatcher.

The apparatus for this dispatching system has been furnished by the Western Electric Company. Passenger and freight trains on the Southern Pacific are equipped with portable telephone sets, enabling train men to get in touch with the dispatcher from any point along the road.

United States Wireless Directory.

The wireless telegraph directory, which has just been published by the United States Government, places the number of wireless stations including those on ships at 1,520. This does not include any ships of foreign governments, or any stations operated by amateurs.

The directory is the work of the Bureau of Steam Engineering of the United States Navy, and lists the wireless telegraph shore stations throughout the world, according to country, giving call letters, wave length, power, range and character of station. There are about 700 of these shore stations.

A separate list shows the forty-seven shore stations of the United States Navy and another the 344 ships of the navy. As an index the final list contains the call letters of every station arranged alphabetically.

A New Telephone Train Dispatching Installation.

A telephone train dispatching system is to be installed on the Queen & Crescent Railroad between Danville, Ky., and Oakdale, Tenn. The distance to be covered is about 137 miles.

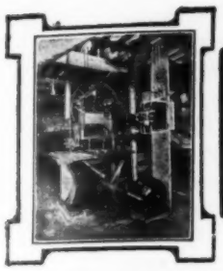
Examination for Inspector of Mechanical Engineering.

The United States Civil Service Commission announces the postponement to December 7-8-9, of the examinations for applicants for the position of inspector of mechanical and electrical engineering in the Supervising Architect's office, Washington, D. C.

The duties of the position consist of inspecting and testing the mechanical and electrical equipments entering into the modern Government or Office Building. It is desired that applicants shall have had practical experience in the design, construction, and inspection of work in the following branches of mechanical, electrical and sanitary engineering: Heating and ventilating apparatus, plumbing, water supply and drainage, conduit and wiring work, elevators, vacuum-cleaning systems, electric-clock systems, pneumatic-tube systems, and electric generating plants. The duties of the position in which the vacancy exists at present will necessitate constant travel on Department business. The salary will be $2,190 per annum.

Applicants should apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of any board of examiners for examination Form 1312.

Advices from Alleghany, Cal., state that the transmission line of the Yuba Hydro-Electric Power Company has been completed to this place and that a further extension will be made to Forest. The idea is to supply power for electrical operation of the mining properties in the vicinity.



Industrial Power

SOME TROUBLES IN CONNECTION WITH RUNNING ELECTRICAL MACHINERY.

BY JAMES A. SEAGER.

The electrical engineer in charge of the operation of plant will very speedily learn that quite apart from the usual troubles relating to electrical apparatus there is a class of breakdown which is particularly noted in connection with machinery which is in a state of motion, and it may generally be said that the proportion of breakdowns, and further, the amount of operating engineers' time devoted to maintenance is higher in the case of running plant than in stationary apparatus, as in transformers, switchgear and the like. As, however, such a large part of generating and even transmitting electrical gear is of the nature of running machinery, it may be interesting to note one or two cases which indicate the way in which trouble occurred and the method adopted in each instance to overcome the difficulty.

In one installation it was found desirable to install a kind of reducing booster, of considerable capacity, consisting of two double-wound armatures, which were arranged so that there were two high-tension armatures, one on either side of the low-tension busbars, thus acting as a reducing booster arrangement, the remaining two armatures being in parallel across the low-tension busbars. The potential difference of the high-tension side was 15,500 volts direct current. In connection with this machine a spare armature was supplied by the manufacturers, and before being placed in the machine was tested for insulation, this indicating five megohms both to earth and between the double windings. The spare armature had not been run on test at the manufacturers' works, as they had probably no suitable field magnets available. The insulation test was taken just before the machine was run up, but immediately the machine was run in order to try the spare armature a burnout occurred between the high-tension and low-tension coils. The only way that this could be explained is that there was probably a slight expansion of the wires forming a coil due to the centrifugal force of running, and this caused the two windings to press together in such a way that a weak place was probably exposed and the machine broke down. This incident indicates very clearly the necessity for something more than a pure insulation test, and it is advisable when ordering new machinery to include in the specification a provision for a full-load running test of some hours' duration and to insist that this is carried out preferably in the presence of a representative of the buyer.

Another interesting affair which indicated the same class of trouble was in the case of a 150-kilowatt two-pole machine. In this particular instance a total breakdown of supply was prevented. The dynamo was running on load when an earth showed on it, and it was immediately shut down and tested. No trace of a fault was found and the machine was then run up separately from the main supply with one pole connected to earth. In this case, although the earth was again apparent, it was not localized, and the armature was then taken out and thoroughly tested. After testing and revarnishing no further trace of the trouble was discovered, and it was then thought that there must be some mistake about the fault. The armature was then put back into its place and again tested while standing idle. This test came out well. It was then run up and once again the earth showed itself. One side of the machine was then earthed, and a 1,000-volt testing generator was at the same time put on it. The fault in this case immediately showed, and it was found that it was due to the windings expanding a little while the armature was revolving, thus causing the insulation of one of the coils to chafe against the stampings. It is evident that the normal supply voltage of 200 was not sufficient to break down the resistance between the defective windings, but the voltage of the testing generator plus the voltage developed by the machine itself (1,200 volts) was sufficient to break down the faulty insulation. It was, of course, impossible to damage the generator on account of its own high internal resistance, but when once the high pressure thus applied had caused the current to jump across the faulty insulation the electromotive force of the machine itself was applied to maintain the arc and so enable the burnout to be located.

This difficulty of insuring tightness in all the working parts of revolving machinery is by no means an inconsiderable one, and very great care has to be exercised in order to see that all nuts and locknuts on the rotating and stationary portions of such machinery are kept up to their work, inasmuch as the vibration is usually very considerable. An instance of this nature occurred in connection with a rectifier in an alternating-current station which was employed to give a unidirectional current for the purpose of supplying street arc lamps. For this purpose a commutator was fixed on the shaft of a synchronous motor, and so placed that a reversal of the external circuit relative to the busbar leads was obtained at the moment when the phase changed its sign. During the course of this run one night the commutator suddenly stopped revolving while the armature spindle revolved freely. This was found to be due to the fact that the commutator was secured to the shaft by means of bolts or retaining screws, which had apparently gradually slacked back unnoticed until the brush friction on the commutator was greater than its power of adhesion to

the shaft. This accident necessitated the shutting down of that particular street arc-lamp service and stopping the machine until the bolts could be tightened up again.

Sometimes faults of this description are due very largely to carelessness in operation and it is not to be wondered at when one remembers that the scale of wages frequently paid to switchboard and station attendants is not always sufficiently high to attract the best type of men or to keep them uniformly keen on their work. It will often be found that the operations on connection with running machinery are carried out in a dull mechanical manner, and that due to this exaggerated routine system, mistakes occur which might easily have been prevented.

The case of a direct-current reducer which broke up under unwise treatment might very easily have been ascribed to a reason of this nature. At the time of the accident two such reducers or motor-generators were running for the purpose of charging a battery in a generating station, and one was being shut down by an attendant who had switched the machine off the busbars. He then proceeded with the intention of breaking the shunt field of the machine which was to be shut down, but by mistake he broke the field on the machine which was not off the bars. This caused the machine to gain excessive speed, and the centrifugal force became so great that the windings burst and tore away the field magnet, parts of the machine flying with great force to a considerable distance. Accidents of this nature are liable to occur even when the plant is put in charge of the most reliable and skillful operator, as every one is in danger of a lapse of memory. Probably the best thing to do in order to avoid trouble of this nature is to group the control switches of each particular machine on the same panel, or so closely adjacent that no mistake can be made as to the switch which is to be handled, and furthermore, to introduce some form of interlocking device between the mechanism so that there is no possibility of operations being carried out in the wrong order.

An accident which is not without its trace of humor may be related in order to show that the eccentricities of running machinery are not altogether due to the faults of the operating and maintaining engineer, but may conceivably be caused by the contractor. There is no doubt that as a general rule contractors' work is well finished and puts the plant into a condition to operate satisfactorily, at any rate for the time of the guarantee. In the case in point, however, the trouble was mysterious. A motor had been connected up for driving a circulating pump and the wiring was laid from the motor to the starter in parallel. The contractor's wiremen had connected up the starting switch, etc., but when it was attempted to run the motor it was found that the machine started away very quickly on the first contact and then slowed down as more of the contacts were cut out, ultimately stopping and then reversing when about half of the resistance had been cut out. There was always a spark from the last contact on the switch to the switch arm when breaking the circuit, so that it was thought that the field was all in order and for some little time the incident caused trouble. It was, however, found that the field lead which ought to have been connected to the brush lead at the opposite pole to the starter had been placed on the same side, and the result of this wrong connection was to put a voltage equal to the drop across the starting resistance through the shunt at the time when the switch arm was on the first contact of the starter. When the arm was moved across the contacts the voltage across the field gradually went down as more resistance was cut out until reversal of rotation took place. The trouble was of course very easily set right as soon as the cause was ascertained.

Occasionally trouble has occurred through causes which could not have been foreseen at the time of installation, and an interesting example of this occurred in an installation in a building which had been in existence for a long time. The generator which supplied continuous current at 2,000 volts suddenly broke down on the armature owing to a leaky roof which allowed water to drop into the armature, causing it to go to earth. Upon repair and pending the erection of a new roof, the trouble was temporarily cured by fixing a hood or bonnet over the magnet pole-pieces, which gave the generator a rather quaint appearance.

The above remarks will be sufficient to show the variety of experience which may occur to an engineer in charge of electrical running machinery, and it is believed will demonstrate the special care and attention which is necessary in order to maintain such plant in satisfactory working condition. There is, however, no doubt that, when properly looked after, direct-current machinery is capable of doing good and useful work under the most trying conditions, and one of the strongest proofs in favor of this argument is the very great extent to which direct-current is used in coal-mine equipments underground. The point to be emphasized, however, is that such running machinery cannot be expected to fulfill its functions for an indefinite period without proper supervision by those who are sufficiently technically educated to understand the points for which it is necessary to watch.

Electric Dredges in the Klondike.

Vice-Consul G. Carlton Woodward, writing from Dawson, Yukon Territory, Canada, states that one gold mining company in that district is building a six-mile ditch capable of carrying 20,000 miners' inches of water to supply a power house for furnishing electrical power for dredges it intends building in the near future. It also intends furnishing power to other dredging companies.

Part of the machinery for this plant has already arrived at Dawson and the balance is on the way. The company contemplates increasing the size of the ditch and adding to the power house in a short time. The machinery and supplies for this power house were principally purchased in the United States.

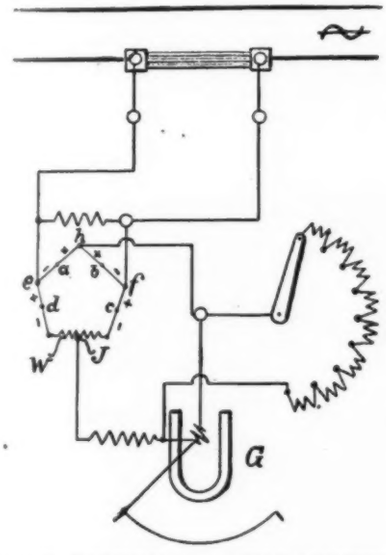
An Electric Flour Mill.

There has recently been erected at Ellesmere Port, England, a $400,000 flour mill in which the whole of the machinery can be brought to a standstill, in case of accident, by means of an electric control which each connected to all of the departments in the mill. The main engine, for driving the generators, is of 1,000 horsepower.

Exports of copper for the month of October were 27,512 tons, against 23,651 tons for the same month last year.

Gossen Precision Millivolt-Ammeter for Direct and Alternating Currents.

Alternating currents may be measured by means of thermo-electric couples by surrounding the elements with wire spirals through which the current to be measured is made to pass. The current heats the spirals and consequently the thermo-electric couples, and as the rise in the temperature is proportional to the intensity of the current, the direct current generated by the thermo-electric elements can be measured by suitable instruments, as movable coil and mirror galvanometers. Mr. Gossen has arrived at a solution of this problem and has designed a practical measuring instrument which is manufactured by Siegfried



GOSSEN PRECISION MILLIVOLT-AMMETER FOR DIRECT AND ALTERNATING CURRENTS.

Guggenheimer of Nuremberg. In the diagram, which will serve to explain the principle of the instrument, *a b c* and *d* are thermo-electric elements in Wheatstone-bridge connection. The direct or alternating current to be measured reaches the bridge at *e* and *f*, traverses it and heats the thermocouples. Equality of potential at *J* and *h* is obtained by regulating the compensating resistance *W*. A needle millivoltmeter *G* of the Deprez-d'Arsonval type is connected to *J* and *h*, and its movable equipment is traversed by the currents from the thermocouples, which are connected in series in groups of two. As the points *e* and *f* are at the same potential, the direct current generated by the thermocouples cannot pass over to the conductors carrying the alternating current to be measured, and the latter can likewise not pass through the millivoltmeter. The instrument thus permits the measurement of alternating current intensities between very wide limits and with great precision and facility. Besides, the values indicated can be verified by means of a direct current. All the Gossen instruments are adjusted for a fall of potential of 225 millivolts between terminals, and they may, therefore, be left constantly in circuit.—*Translated and abstracted from L'Electricien, Paris, June 4, 1910.*

Sterilization by Ultra-Violet Rays.

The bactericidal action of ultra-violet rays having been known for several years, it was to be expected that numerous attempts would be made to apply this property to domestic and even industrial uses, particularly for the sterilization of water. At the recent exposition of the French Physical Society three different apparatus of this kind were exhibited. The sterilizing action of the ultra-violet rays seems to manifest itself only in clear water; bodies in suspension or colloids seem to arrest or diminish the efficacy of the process The bactericidal action of the rays still appears to be sufficiently strong after they have passed through a layer of water thirty centimeters in thickness. Mr. Billon-Daguerre simply places a mercury-vapor lamp in a tube, through which the water circulates. A similar arrangement has been adopted by Dr. Nogier in his apparatus. The mercury

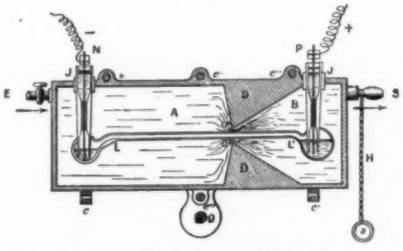


FIG. 1.—NOGIER STERILIZER.

lamp (Fig. 1) consists of a quartz tube with branches leading to electrodes outside of the tube through which the water circulates. The water reservoir is divided into two chambers, *A B*, connected by a narrow passage, so that the water is compelled to pass very close to the tube producing the rays. The lamp is lighted by causing the entire apparatus to tilt around the point *D*. In tests the output was four liters of sterilized water a minute with a current consumption of five to ten amperes at 135 volts. In the Westinghouse, Cooper Hewitt Company's sterilizer a mercury-vapor lamp of the "Silica" type is suspended above and near the surface of the liquid (Fig. 2). The water passes through the valve *A*, enters at the bottom of the annular space between the two cones shown in the illustration, and is subjected to the action of the rays when it arrives in the upper basin, from where it is discharged through the cen-

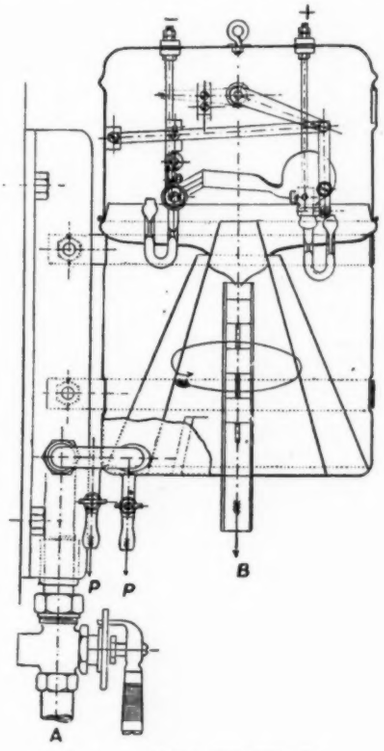


FIG. 2.—"SILICA" STERILIZER.

tral tube *B*. The apparatus delivers 600 liters of sterilized water an hour with a curent consumption of 3.5 amperes at 110 volts.—*Translated and abstracted from La Revue Electrique (Paris), May 15.*

Small Lighting Plants for Canada.

Consul-General John E. Jones, of Winnipeg, Manitoba, Canada, has filed with the Bureau of Manufactures, Washington, D. C., a list of the cities in western Canada with a population of 500 or over, in which he believes there are fine opportunities for installing small electric lighting plants. He recommends the sending of competent representatives to exploit this profitable territory.

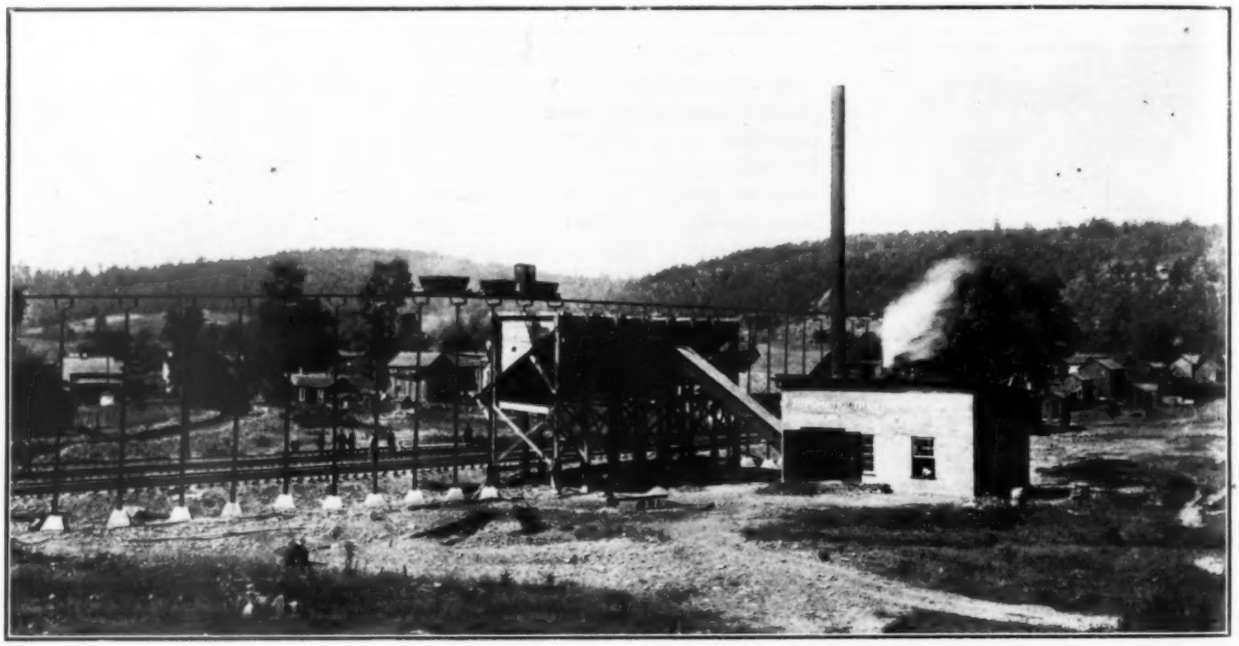
An Electric Railway Without Grading.

An overhead electric railway of comparatively simple construction and requiring no expensive roadbed and grading, has been constructed at Blossburg, Pa., to connect the mines of the Jenkins Brothers and the Nowak Coal Company to the nearest railroad siding, a distance of about one mile.

The track rails are secured to malleable iron wyes which in turn rest on a series of single iron posts supported in concrete foundations. The length of these posts correspond to the contour of the ground. The elevation thus varies from a few feet, at several points in passing down the mountains, to thirty-one feet, near the tipples at the railroad siding. The gauge of the line is thirty inches.

The car trains consist of two electric motor cars (capacity one ton of coal each) and four trailers (capacity 1½ tons each). The current is taken from one of the rails, the point of contact being in a V-shaped groove located on the underside of the rail so as to be unaffected by adverse weather conditions. The trains can be operated either by a motorman or automatically. The time for a round trip, including loading at the mine and automatic dumping at the tipples, is fifteen minutes or less. The line at present is transporting about 300 tons of coal a day but its capacity is estimated at 1,000 tons.

This electric line was installed by the Automatic Transportation Company, of Buffalo, N. Y., as was also the modern concrete power house which has been built adjoining the tipples at the railroad siding. The new transportation system is reported to be giving satisfaction to the mine operators and its cost is stated to be much less than that of a steam road operating under similar conditions.



TERMINUS OF BLOSSBURG ELECTRIC LINE, SHOWING POWER HOUSE AND TIPPLES.

Neutralizing "Static" in Textile Work.

In the course of a paper entitled "The Electrical Engineer and the Textile Machinist," read by Frank Nasmyth at the Manchester (England) Engineering Exhibition, on October 17, 1910, the author described an ingenious device, known as the Chapman electric neutralizer, which has been introduced for neutralizing the effect of static electricity generated by the friction of textile fibers during treatment.

It is applied in the following manner: A special transformer is provided, which is bolted up to the wall or ceiling in any convenient place and serves to deliver the electric current in the proper form to the various machines where the static electricity is to be neutralized. A single line of heavy insulated wire leads from the transformer to the various points of treatment. This line may be run along the ceiling over the machines or under the floor on which the machines set. On each machine is placed one or more inductors connected to the line wire. The inductor is a steel tube one and one-half inches outside diameter, of suitable length to reach across the machines, slotted on one side from end to end, and having a series of porcelain blocks in the slot. These blocks contain the active points from which the influence is radiated to the charged material, and a heavily insulated cable runs through the inside of the tube and distributes the alternating charge to the several active points by induction. The tube itself is grounded, but the line wire is connected directly with the cable inside the tube. The connection is made through a convenient form of removable socket at the end of each inductor. The inductor is placed at some point in the machine where the charged material may pass by it at a distance of from one inch to three inches, and the material becomes instantly neutralized thereby, even when running at 1,000 feet a minute.

Electric Drive for Indian Mill.

The Hindusthan Cotton Mills Company, Limited, will shortly build at Calcutta, India, a mill to weave fancy cotton goods. According to an Indian exchange, "The power used will be electricity, both because this will lower the initial expenses and be more economical and cleaner in the working."

BOOK REVIEWS.

"Elementary Mechanics for Engineering Students," by F. M. Hartmann. New York: John Wiley & Sons. Cloth, 171 pages (7¼ x 4¾ inches). Supplied by the Electrical Review Publishing Company for $1.25.

As indicated in the title, this volume has been written for engineering students, and has been elaborated from a course of lectures delivered by the author at Cooper Union. Advanced mathematics has been avoided, but some knowledge of trigonometry has been assumed upon the part of the reader. The elements of mechanics have been put in very simple form, but the treatment is so concise that most students would have difficulty with it unless taking up the subject with an instructor, as intended by the author. A collection of problems with answers is appended.

The chapter on elasticity deserves special mention, as the subject has been treated in an admirable manner, and relations that are sometimes obscure have been presented in a very clear manner.

The book deals only with the elements of the subject, and these are very well covered in the twelve chapters. Motion is first treated and is followed by a consideration of force, work, momentum, impact, moment of inertia, torque, oscillations, falling bodies, elasticity and statics. A chapter is devoted to the determination of maxima and minima without the use of the calculus.

"Miscellaneous Tests of Electric Car Equipment." By Eugene C. Parham and John C. Shedd. New York: McGraw-Hill Book Company. Cloth, 156+X pages (7½x5 inches), with 74 illustrations. Supplied by Electrical Review Publishing Company for $1.00.

This is another of the excellent practical books on testing written by these authors. This particular volume is a companion to the one on "Shop Tests on Electric Car Equipment." Not only does it give further tests to be made with the car stationary, but also a great number to be applied when the car is in motion. In the former category are numerous tests on current collectors, car fuses, circuit-breakers, controllers, starting coils, lightning-arresters, wiring cables and motors. The motion tests comprise tests of motor balance, heating, efficiency, energy absorption and miscellaneous tests, such as speed, acceleration and retardation tests, determination of train resistance, horsepower of traction, total horsepower of operation, etc. Near the end of the book are given useful suggestions for reviving shocked persons and for relieving burns. A series of helpful review questions concludes the volume. As each part of the equipment is taken up, it is first briefly described, the object of the tests explained and then the directions for carrying them out given in detail. The tests enumerated are easly applied and the instruments necessary are such as are usually on hand. The book is therefore of great value to traction-equipment inspectors and foremen.

"Standard Handbook for Electrical Engineers." New York: McGraw-Hill Book Company. Flexible leather, 1,497 pages (4x 6¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $4.00.

This third edition has been thoroughly revised from cover to cover and contains about forty per cent additional matter. Practically every section of the book has been enlarged and many have been completely rewritten to conform to modern practice. The work was originally prepared by dividing the entire field of electrical engineering into about twenty sections and treating each independently. This has made it possible to revise and enlarge each section with a minimum amount of trouble and without any of the usual limitations. In addition to the changes already mentioned many new tables and other valuable data have been added.

Union Elevated Loop Power Troubles.

Through a remarkable series of accidents the power house of the Union Elevated Railroad, at Market and Charles Streets, Chicago, was completely put out of commission during the early morning rush hour on November 3. This station supplies power to the Union Loop used by the four elevated railroads of Chicago and has an equipment of three engine-type generators of 1,500 kilowatts each and one similar generator of 1,600-kilowatts rating.

It has been the custom to overhaul completely one of these generating units each summer. This was done last July, but the extensive repairs found necessary were not yet completed. On October 24 the second unit was put out of commission by the short-circuiting of several armature coils, presumably from continued overload, as the station is taxed much over its rated capacity to provide for the heavy rush-hour service. Arrangements were made with the South Side Elevated Railroad to supply power to one of the four sections of the loop. On November 1 it was found that the engine of the third unit had developed a loose crank pin, so it was shut down and a second section of the loop carried by the South Side road. At 6:20 a. m. on November 3 the fourth and last unit was thrown out of service by the burning out of three of its armature coils.

As the other elevated railroads could supply but little extra power beyond their own needs, it was necessary to reduce the number of trains using the loop from forty-two to twenty-nine. Arrangements were also made to have the Metropolitan Elevated supply power to one section temporarily and the Chicago Railways Company the fourth section along Van Buren Street, along which it fortunately had four spare feeders from its substation at Van Buren and Jefferson Streets. By the following day several more trains could be run around the loop. On November 5 one of the generating units had been put back into commission and the regular service resumed on the loop. On November 7 a second unit had been repaired sufficiently to be placed into service again and on November 9 the third unit was added, so that the emergency arrangements could be dispensed with.

Plans are now being considered for increasing the capacity of the plant by installing one or more rotary converters of 2,000 kilowatts each, the power to these to be supplied by the Commonwealth Edison Company.

John S. Lawrence, special master in the equity suit of the Real Estate Trust Company *versus* The Michigan Lake Superior Power Company, has issued notice that all creditors of the Power Company are required, before January 20, 1911, to present before him at Grand Rapids, Mich., full and itemized statements of all claims against that corporation. Such statements shall be duly verified and show the claim is secured and by what form of security. Where any claim is disputed, objections must be filed by February 20, 1911.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

MASSACHUSETTS ELECTRIC.

The Massachusetts Electric Company has issued its statement for the quarter ended September 30, compared as follows:

	1910.	1909.
Gross	$2,741,764	$2,627,877
Expenses	1,434,626	1,290,899
Net	1,307,138	1,336,978
Charges and taxes	459,512	432,374
Surplus	847,625	904,603

The Massachusetts Electric Company's fiscal year ends September 30, and we therefore give the figures for the twelve months ended September 30, compared as follows:

	1910.	1909.
Gross	$8,560,949	$8,051,319
Expenses	5,360,295	5,147,361
Net	3,200,654	2,903,958
Charges and taxes	1,792,936	1,778,128
Surplus	1,407,717	1,125,829
Preferred dividends	95,544	42,569
Surplus	1,312,173	1,083,260
Reconstruction written off	268,992	103,834
Surplus	1,043,181	979,425

NEW ENGLAND TELEGRAPH AND TELEPHONE.

The New England Telephone and Telegraph Company has filed with the Massachusetts Highway Commission its annual statement for the year ended June 30, 1910, compared as follows:

	1910.	1909.
Gross	$12,225,332	$11,031,289
Expenses	8,885,418	8,306,473
Net	3,339,914	2,724,816
Other income	303,052	260,004
Total net	3,642,967	2,984,821
Charges	120,531	161,035
Balance	3,522,436	2,823,786
Dividends	2,898,477	2,194,639
Surplus	1,223,959	629,147

MONTREAL STREET RAILWAY.

The Montreal Street Railway Company has issued its report for the year ended September 30, 1910. The income account compares as follows:

	1910.	1909.
Gross	$4,352,551	$3,874,838
Expenses	2,455,301	2,255,019
Net	1,897,250	1,619,819
Interest from M. P. & I.	85,878	55,606
Total income	1,983,128	1,675,425
Charges and taxes	507,978	445,749
Surplus	*1,475,150	1,229,676
Dividends	1,000,000	976,332
Balance	475,150	253,344
Insurance and conting. fd.	275,000	200,000
Surplus	200,150	53,344

*Equal to 14.75 per cent on $10,000,000 capital stock, before charging out insurance and contingent reserves, as compared with 12.29 per cent earned on same stock in previous year.

DETROIT UNITED RAILROAD.

The report of the Detroit United Railroad Company for the month of September and nine months ended September 30, 1910, compares as follows:

	1910	1909
September gross	$ 846,297	$ 751,818
Expenses	540,051	477,851
September net	306,246	273,967
Other income	11,144	11,763
Total income	317,390	285,730
Charges and taxes	178,802	158,124
September surplus	138,588	127,606
Nine months' gross	7,027,978	5,963,431
Expenses	4,485,425	3,702,532
Nine months' net	2,542,553	2,260,899
Other income	113,207	108,206
Total income	2,655,760	2,369,105
Charges and taxes	1,511,120	1,409,507
Nine months' surplus	1,144,640	959,598

METROPOLITAN STREET RAILWAY.

The New York Public Servie Commission has issued a report of the receivers of the Metropolitan Street Railway Company for the quarter and twelve months ended June 30, 1910, compared as follows:

April 1-June 30:	1910.	1909.
Gross	$3,317,191	$3,324,166
Expenses and taxes	2,934,759	2,216,995
Net	382,432	1,107,171
Other income	43,117	35,647
Total income	425,549	1,142,818
*Charges	653,017	646,179
Surplus	†227,468	496,638
July 1-June 30:		
Gross	13,217,117	13,198,786
Expenses and taxes	10,461,426	.....
Net	2,755,691	.....
Other income	186,839	.....
Total income	2,942,531	2,344,615
*Charges	2,608,118	2,689,915
Surplus	334,412	†345,300

†Deficit. *Does not include interest on $12,500,000 general and collateral trust five-per-cent bonds; $16,604,000 refunding four-per-cent bonds; $600,000 Metropolitan Crosstown five-per-cent bonds.

HUDSON AND MANHATTAN.

The New York Public Service Commission has issued a report of the Hudson & Manhattan Railroad, for the quarter and twelve months ended June 30, 1910, compared as follows:

April 1 to June 30:	1910.	1909.
Gross	$641,581	$205,208
Expenses and taxes	292,976	145,909
Net	348,605	59,299
Other income	243,394	181,285
Total income	591,999	240,584
Charges	574,698	165,184
Surplus	17,301	75,399
July 1 to June 30:		
Gross	2,237,459	743,702
Expenses and taxes	1,181,435	.....
Net	1,056,023	.....
Other income	882,656	.....
Total income	1,938,679	724,264
Charges	1,919,389	659,893
Surplus	19,289	64,370

WEST PENN TRACTION.

The statement of the West Penn Traction and subsidiary companies for the nine months ended September 30, follows:

Net earnings after expenses and taxes	$698,186
Other income	48,690
Total income	$746,676
Interest	345,949
Balance	$400,727
Five per cent. on West Penn Rys. pfd.	103,125
Two per cent. on $3,200,000 com. stock	48,750
Balance	$249,052
Six per cent. on pfd. stock West Penn Traction	73,125
Surplus	$175,927

BROOKLYN RAPID TRANSIT.

The New York Public Service Commission has issued a report of the Brooklyn Rapid Transit system for the quarter ended June 30, 1910, compared as follows:

	1910.	1909.
Gross	$5,572,257	$5,284,481
Expenses and taxes.	3,587,250	3,794,492
Net	1,985,007	1,489,989
Other income	96,299	95,137
Total income	2,081,307	1,585,126
*Charges	108,651	118,446
Surplus	509,262	252,874
April 1 to June 30:		

In the above statement inter-company transactions involving duplications have not been eliminated.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

NED MOSHER, of Old Town, Me., has entered into the electrical contracting and supply field.

SCHWARTZ & JOHNSON, of Pekin, Ill., recently formed a partnership and started on electrical supply and contracting business.

THE JOHNSON ELECTRIC COMPANY, of Omaha, Neb., was awarded the contract for wiring the new County Building, in that city, at a price of $11,262.

THE STEUBEN ELECTRIC COMPANY, Steubenville, Ohio, has been established by R. B. Maxwell. The company will do a general wiring, supply and contracting business.

THE SOUTHERN ELECTRICAL SUPPLY COMPANY, Waycross, Ga., has been awarded the contract for electrical work in the Sunday school annex of the Methodist church of that town. B.

THE WHITEHALL ELECTRIC COMPANY, Westerly, R. I., has opened a new store at No. 42 Main Street. Part of the new store has been fitted up as a stock and work room, so that the company is especially fitted to take care of contracting work.

THE SYRACUSE ARMATURE ELECTRIC EQUIPMENT COMPANY, with the principal office at Syracuse, N. Y., has been incorporated to do electric work of every description, both as electrical engineers and jobbers. The concern will also deal in electrical dynamos. The capital is $15,000 and the directors are: J. J. Hennessey, E. A. Capalsefalo and D. K. Spier, all of Syracuse. T.

THE ELECTRIC SUPPLY COMPANY, Columbus, O., has secured the contract for electric work on the new high-school building at Delaware, O., and is also completing a number of other municipal contracts. The company also furnished and installed electrical equipment of the new State Hospital at Lima. The officers of the company are: C. C. Slater, president; W. H. Sharp, vice-president; J. K. Henry, secretary and treasurer.

New Electrical and Mechanical Apparatus and Appliances.

A New Electric Range.

The kitchen equipped with electric heating devices is a "model kitchen," free from smoke, ashes, gas odors, fire hazard from naked flames, prostrating heat in summer time, delays waiting for the kindled fire to burn, nuisance of matches, etc. The bustling housewife of the present day gladly adopts devices which add to her convenience or enable her to prepare food in a more sanitary manner. Electric heating devices mark a great stride forward in both respects and are being widely adopted.

The domestic electric range recently perfected by the General Electric Company is a decided advance in the right direction. It is patterned after the ordinary gas range and cooking can be done with it as quickly as with gas or coal, due to the fact that the heating elements are made of calorite, a new alloy discovered after years of scientific investigation in the research laboratories.

GENERAL ELECTRIC COMPANY'S ELECTRIC RANGE.

There are three disk stoves on the top of the range designed to be used in the same manner as the burners of a gas range. A turn of the snap switch turns on the heat instantly at full intensity, while another turn cuts it off and so permits the elimination of any expense for current when the stove is not actually in use, without incurring a delay in getting it into operation again. The two larger stoves are provided with a switch which admits of a three-heat regulation, thus making it possible to get a low, moderate or high heat as conditions may require. The three stoves permit cooking one, two or three things at once.

The combination oven and broiler is commodious, being 18 inches by 18 inches by 12 inches, and ample for the needs of a large family, and is provided with heating units at both top and bottom. By removing the ceiling plate of the oven, the top heating element of the latter is exposed and may be used as an overhead radiant broiler, or for the purpose of producing a pronounced browning of pies, biscuits, roasts, etc. The ceiling plate can be used as a shelf to support the broiling pan at the proper distance below the heating element. The slide supports on the side of the oven permit vertical adjustment of the broiling pan and oven shelves, and also the use of several shelves at once. The broiling pan (which is furnished with the range) is also suitable for use as a roasting pan. The stoves, broiler, and oven have independent controlling switches. It is not necessary to use a thermometer with this oven, as the temperature attained at the various positions of the switch for the intervals of time stated in the instructions accompanying the range will be best suited for each individual case.

The space between the stove top and the oven is heated indirectly from the oven, broiler and stoves, and so makes a convenient plate and food warming closet.

To increase the usefulness of the range two additional outlets are provided for individual electrically heated devices; one being an outlet for a percolator, etc., of one heat and not over 600 watts, the other an outlet for a grid or other three-heat electric device, a three-heat switch being mounted on the range for its control.

The circuits to each part of the range are separately fused by a double-pole fuse block, while a main fuse of sixty-ampere capacity protects the entire range. The wiring is arranged for either two-wire or three-wire connection.

The range is of sheet-metal construction throughout, made in a workmanlike manner and finished with nickel trimmings.

The oven door is of the spring drop style and is provided with a substantial and effective latch.

Westinghouse Electric and Manufacturing Company Gets Contract.

Advices from Pittsburg state that the Westinghouse Electric and Manufacturing Company has received contract from the Boston & Maine Railroad for the complete electrification of the Hoosac Tunnel under the Hoosac Mountain, in Massachusetts. Work is to be started at once on the improvement, with the expectation of having it in readiness for service early in the spring. This contract involves more than $1,000,000.

Commercial Vehicle Run in New York.

Out of forty entries in the First Commercial Vehicle Run held in New York City, twenty-four were electrics and seventeen of these General Vehicle machines. Private owners showed their interest in this public-spirited event by entering twenty machines, only one being of the gasoline type, however, and the results showed, at least to the men following the run, that there is absolutely no question of the wonderful reliability and consistent performance of the electric machine.

The Central Brewing Company entered its oldest machine. *Mary Ann*, nine years old.

The New York Edison Company entered five machines, as follows: The 1,000-pound lamp wagon averages about forty miles per day, making about thirty-five stops and delivering from 800 to 900 lamps between eight in the morning and five in the afternoon. It has not lost a day since being put in commission, January 7, 1910.

The 2,000-pound repair wagon is used by the Overhead Line Department, carrying both material and men, averaging 35 miles daily, although often doing from 45 to 50 miles. This truck has lost no time since purchased in July, 1909.

The two-ton truck is used in handling important freight between stations and averages about forty miles per day.

The 3.5-ton, equipped with a hoist, is used in setting poles and has recently completed placing 192 on the Grand Concourse and has established a record, having handled five poles per hour.

Last winter this truck was used for a most unusual work, that of thawing water pipes. In one case it saved the shut-down of a factory after the owner had spent about $1,000 trying to get his water mains cleared.

The five-ton truck is used by the Underground Cable Department, being equipped with a winch, and has pulled as high as 4,000 feet a day of heavy cable (about twelve pounds per foot). Lengths handled are sometimes over 650 feet long. No figures are needed to show the wonderful economy of the power truck in work of this kind, and certainly no application of power can be smoother or more accurately controlled than that obtained from the electric motor.

The five-ton machine of the Brooklyn Edison Company is also a cable machine and has been used for some time, particularly in connection with Coney Island distribution. This truck, during one of the periods of heaviest load, made a total of fifty-four miles

"MARY ANN."

in one day. On other days mileage is lower, the power being used for cable hauling.

The Apmann & Meyer 2,000-pound bread wagon averages about 36 to 38 miles daily and the same driver is now doing nearly twice the work formerly done with horses. In fact, in removing this truck from service for the run, it was necessary to use two horse-drawn teams in its place, meaning two drivers in place of one.

The Borden Condensed Milk wagon, a 3.5-ton machine, is used in handling about 250 cases of bottled milk daily. This truck does about thirty-eight miles a night, and has proved a most profitable investment.

The Guinness Stout wagon of Alex. D. Shaw, has replaced four horses. This truck, due to its original body design and handsome lettering, was one of the "show pieces" of the run.

The 2,000-pound General Electric machine is used in special delivery work, and although its mileage is low—twenty-eight miles daily—it required the introduction of two light horse wagons to take care of customers in the usual fashion, simply because horses cannot cover the ground as rapidly as the power vehicle.

The five-ton truck of the Central Brewing Company does from 35 to 38 miles daily, handling a load of fifty half-barrels.

The 1,000-pound machine entered by the General Vehicle Company in the Transfer Class, handled its sixty-five miles' run very readily with a full load and after the finish it officially made a total mileage of 87.6 without exhaustion, proving that the electric is readily equipped to negotiate all the mileage that can be done commercially in a working day.

Similarly the 3,000-pound furniture wagon chassis entered by the General Vehicle Company, showed a good margin over and above the sixty-five required, although no run-out was made.

TRUCK OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN.

A brief résumé shows that every standard General Vehicle truck of recent design made a perfect score on both days and that those which did

require additional power were those taken from active and satisfactory service, but with battery capacity inadequate for the mileage laid out as the test run, greatly in excess of usual working needs.

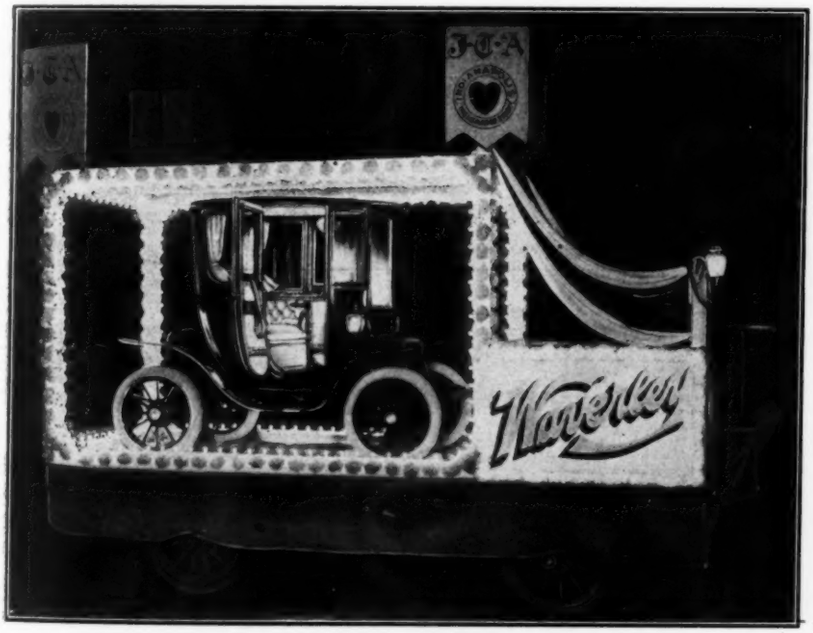
The two entries of the United Electric Light & Power Company, one a 3.5-ton cable truck and the other a 2,000-pound repair wagon, are standard vehicles with electric-light companies generally and are two of the ten recently purchased from the General Vehicle Company.

A Waverley Display at Night.

The Indianapolis Trade Association entertained a number of out-of-town buyers recently with a great industrial parade given at night, which was witnessed by fully 150,000 people.

The automobile industry of the city was well represented, although the position accorded it in the parade did not indicate a just appreciation of its importance on the part of the management. The people, however, showed their appreciation of this feature of the pageant by the applause they gave it.

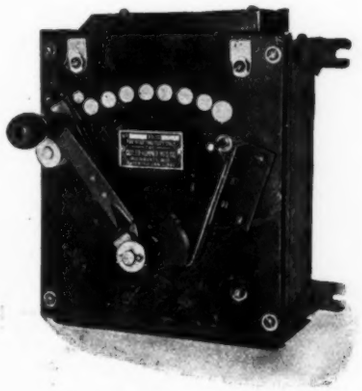
The display of the Waverley Company, illustrated herewith, caused much spontaneous applause. Its delicacy and simplicity seemed to appeal. A large automobile truck bore a framework in outline decorated with flowers and made brilliant with rows of electric lights, displaying an electrically lighted electric automobile.



WAVERLEY ELECTRIC AUTOMOBILE ON FLOAT.

Single-Phase Motor Starters.

The single-phase motors in use have usually been of very small capacity, but the development of the self-starting type of motor has made the use of large motors, starting with partial load, practicable. However, the starting current is very large and the line disturbances that result are especially undesirable on lighting systems.



SINGLE-PHASE MOTOR STARTER.

To prevent such occurrences and provide a serviceable apparatus for starting, the Cutler-Hammer Manufacturing Company of Milwaukee has developed a primary resistance starter for single-phase self-starting motors.

This starter, shown in the accompanying illustration, has been specially designed to meet the requirements of alternating-current motors.

The resistance is of the ventilated tubular type, so arranged as to eliminate the effect of inductance and provide the highest possible power factor obtainable in starters of this type.

A hub spring attachment prevents an operator from leaving the lever on an intermediate contact, while it is held in the running position by a spring pawl, which engages a notch in the fan tail of the lever.

The standard apparatus is made for 110 and 220-volt circuits, sixty and 133 cycles, in sizes up to thirty-five horsepower. When desired the starter is equipped with no-voltage release, which trips the latch holding the lever and allows it to return to the starting position in case of failure of current.

Guarantee Electric Company Enters Supply Business.

The Guarantee Electric Company, Chicago, Ill., was organized September, 1899, and thereafter for a few years occupied small quarters at 131-139 South Clinton Street. In September, 1901, having outgrown these quarters, the company was compelled to move into a larger home on the corner of Adams and Clinton streets. The growing process continued, and during the early months of this year, having secured possession of the property on the southwest corner of Van Buren and Clinton streets, the Company erected a handsome modern building, with traveling cranes, and in every way most admirably adapted to its needs.

In the early days second-hand motors and dynamos, and a few specialties comprised the line. Later a second-hand supply department was opened. The Company continued with these lines, and its general electrical repairing, in which field it has won a well-known reputation, gradually adding more and larger units to its stock, and finally handling new supplies. New electric cranes are necessary to handle the heavy units.

The latest machinery is installed in the shop for rebuilding electrical units and switchboards, and in the supply end the second-hand line has been replaced by a complete new stock of all of the many articles popularly known as electrical supplies. Such growth has only been possible through the support of many satisfied customers.

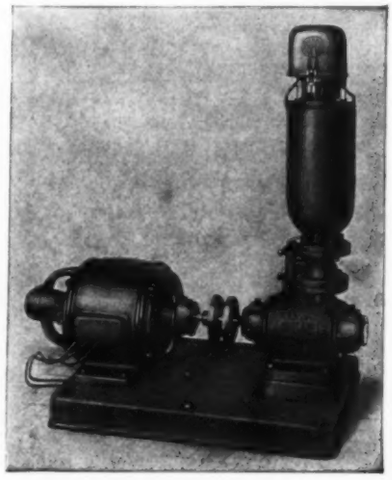
In the supply department the right prices and the quickest possible delivery count. In the machine department every unit is tested under full load before shipment and is guaranteed for a year.

A New Rotary House Pump for Automatic Water Supply.

A new type of house service pump has recently been introduced into this country from Germany, where it is in extensive use and has been operating successfully for several years. The pump is the invention of Herr Wilhelm von Pittler, of Berlin, Germany, and the American rights, including those for the controlling apparatus and other accessory devices, have been secured by the Rotary House Pump Company, with offices at 103 Park Avenue, New York City.

The pump consists of a rotating cylinder or drum of bronze, rigidly secured to the shaft and revolving between two end cams having parallel curved faces. The cylinder has rectangular slots in its surface, which are machined out parallel to the axis and contain sliding vanes. The whole is inclosed in a casing containing ports which connect the pumping chambers with an outlet and inlet. The two end faces of the rotating cylinder are plain surfaces, perpendicular to the shaft. The end cams have special surfaces, which form a series of working chambers around the shaft at either end of the rotating cylinder. The ends of the vanes enter these working chambers by reason of the cam surface at the opposite end. There is a port in the casing over the first part of each working chamber connected to the inlet. As a vane moves under this port, water is sucked in between the rotating cylinder and the cam, to be discharged through a second port at the other end of the chamber and so to the discharge pipe. While the vane is under either port, it is moving axially, and is subjected to equal pressures on each side; between ports the surfaces of the cams are parallel to the ends of the rotating cylinder and the vane has no axial movement. In other words, there is no sliding of the vanes in the cylinder except when they are under open ports, and therefore submitted to equal pressures on both sides. Whenever the vane is under load and pushing the water forward in the pumping chamber, it is moving along the flat part of the cam head, while it rotates with the cylinder, but does not slide in the same.

If perfectly clear water was at all times being drawn in and discharged from the Pittler pump, solid vanes would give satisfactory service. But average practice shows that nearly all water contains grit or solid matters of some kind, which causes a certain amount of wear on the ends of the vanes butting against the cam heads. The pump is constructed, for this reason, with vanes divided through the



ROTARY HOUSE PUMP.

center. Pressure is introduced between the two halves by leading a small channel from the discharge to a groove, which entirely surrounds the rotating cylinder. By this means, the vanes are kept always in contact with the cams at either end and the wear on the ends of the vanes is automatically taken up, maintaining the efficiency of the pump.

The Pittler rotary pump is designed for direct connection to any type of electric motor, doing away with belts or gearing. The light moving parts have little inertia or starting friction and require no excessive power at starting. They also eliminate the necessity for heavy foundations. The head, against which the pump is desired to deliver water, depends on the size of the motor and the strength of the materials of which the pump is constructed. In other words, the pump will deliver against heads of very wide limits by simply coupling it to the proper sized motor.

The lubrication is entirely automatic and as reliable as that of standard electric motors, as it is only necessary to lubricate the shaft which runs in ring oiling bearings of ample dimensions. There being no valves or stuffing boxes, the pump is reliable during continuous operation and will not dry out if allowed to remain idle.

The pump is applicable to all classes of pumping work combining the advantages of rotary action as with turbine or centrifugal pumps with the positive delivery of a displacement or piston machine.

The apparatus is entirely self-contained and consists of an electric motor, direct connected to a rotary pump. Above the pump (or in some types underneath) is a small pressure chamber or reservoir partly filled with air, which is compressed by the pressure of the water from the pump. At the top of the air chamber an automatic switch is actuated by means of a diaphragm, which throws in or cuts out the current, depending upon this pressure. The automatic switch is adjusted to operate between any two given pressures, starting the motor at the lower one and stopping it at the upper one, so that a pressure within these limits is maintained at all the taps and faucets in the building.

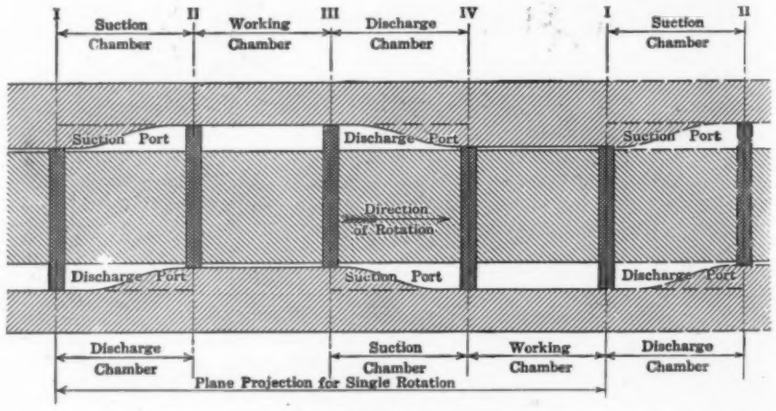


DIAGRAM OF PUMP.

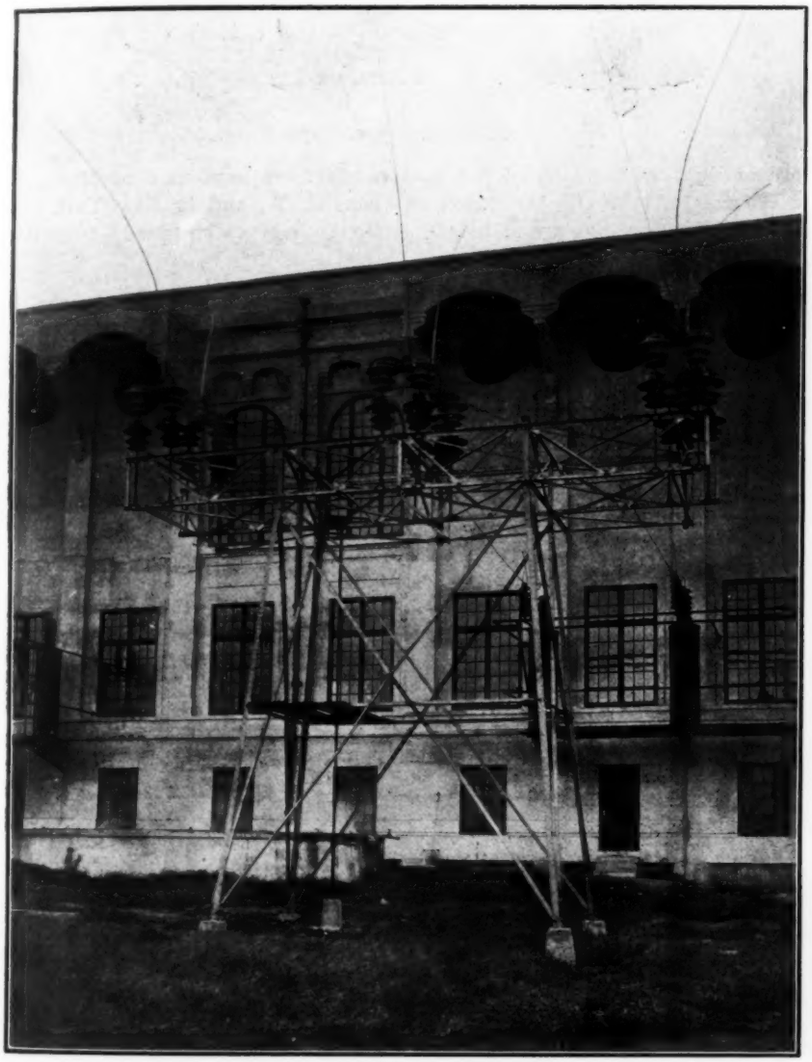
In the wireless telegraph directory recently published by the government, 1,520 stations are listed.

Test of 104,000-Volt Kilarc Switch.

At the Bay Shore substation of the Sierra & San Francisco Power Company is installed a Type L Kilarc switch, built by the Bowie Switch Company, through which passes one of the incoming lines of the Stanislaus Power Company, which supplies the United Railroads of San Francisco with power. The transmission system is operated at 104,000 volts, one of the highest pressure at present in commercial use. This switch was built to handle at least 10,000 kilowatts, and to open under load. The operating parts for breaking the load are similar in principle to those of the standard Type K switch built by the same company. By the direction of motion of the blade, the arc is first drawn upwards, away from the insulators, thereby avoiding any possibility of the heat of the arc affecting the insulators.

This switch which has been in service for over the last three months, is situated in a location particularly severe on insulators owing to the salt fogs, high winds, and dust, and the insulators have not been cleaned since it was installed.

To determine the ability of the switch to open under load, a test was recently made by loading the line with an inductive current of fifty-two amperes on the high-tension side, for over 9,000 kilovolt-amperes. The switch handled the load without the slightest difficulty, and opened without causing any voltage disturbance to the system, other than would occur from the change of current. There was practically no surge on the line, and the pressure at the power house raised only 3,500 volts, or about three per cent maximum when the switch was opened. This demonstrated conclusively that no material rise of voltage accompanies the opening to this type of horn switch.



THE 104,000-VOLT KILARC SWITCH AT BAY SHORE SUBSTATION ON LINE OF SIERRA & SAN FRANCISCO POWER COMPANY.

This is a subject which has caused considerable discussion by engineers, as some have maintained that the opening of air switches would set up serious oscillations in the line. This opinion is without doubt due to the use of air switches of improper design, where the break in the circuit occurs in an arc which is ascending in nearly a vertical direction, and where the rupture of the arc will occur in such a manner that the ascending column of heated air will cause the arc to reform. In horn switches of the design shown, it is a practical impossibility for the arc to break in such a manner, since the tendency for the arc to rise is so strong, that with proper inclination of the horns, the break will be substantially horizontal, and in such a manner that there is no possibility of reformation of the arc, and hence there will be no surging. The results of extended experience with these switches have shown that they will operate without causing material disturbance of voltage, and in this respect are considerably superior to oil switches, owing to the high resistance of the long arc, which greatly weakens the current before the final break.

This test was particularly severe owing to the highly inductive load which tended strongly to maintain the arc, and to have the stored magnetic energy kick back on the line.

Judging by the manner in which the switch operated, without doubt its actual capacity is far in excess of the rating. The photograph shows a view of the switch which is mounted on a structural steel framework thoroughly braced, and mounted on a steel tower.

Great Electric-Delivery Service.

The recent electric-delivery service installed by Gimbel Brothers, of New York, shows a combination of hard-headed business economy, progressiveness and a keen appreciation of the advertising value of swift, sure and silent delivery. Their initial installation covers a total of sixty-six vehicles, thirty-six of which are for small-package delivery, and thirty for heavier service, ranging in size from two to five tons.

The entire line of vehicles was built by the Studebaker Company, and all are equipped with Westinghouse motors, controllers, main switches, charging plugs, and receptacles. The motors for the package-delivery wagons are known as the type-V-20-A motor rated at thirty-one amperes, fifty volts, 1,250 revolutions per minute. From this size the motors increase up to the store truck which is equipped with two type-V-30 motors rated at eighty volts, thirty-five amperes, 800 revolutions per minute. All motors are series-wound, and all are provided with ball bearings. The vehicles are equipped with Westinghouse continuous-torque metal-drum series-parallel controllers, giving five speeds forward and five reverse.

Electric vehicles have now passed the experimental stage and their great superiority over horse-drawn vehicles and other tractors, especially for service in congested districts, has been demonstrated. From standpoints of economy, speed reliability under all conditions, durability, cleanliness, in fact from almost every conceivable standpoint, the electrically driven delivery wagon has much the advantage.

The Gimbel Brothers' store now has a delivery service second to none in New York City and probably to none in the world. The advertising value of these handsome vehicles traversing the streets of New York and the surrounding cities, and towns, is incalculable.

Electrical Opportunities in Bolivia.

In the Bolivian budget for 1910 the following items of expenditure appear: 89,000 bolivianos for the construction of new telegraph lines; 50,000 bolivianos for the reconstruction of existing telegraph lines and the purchase of conductors; 115,500 bolivianos for waterworks and sewage works; 204,000 bolivianos for the construction of public works in general. The boliviano is equivalent to approximately thirty-nine cents United States money.

The *Bulletin Commercial*, of Brussels, of July 2, 1910, quoting from a report by the Belgian Legation at La Paz on the condition of the electrical industry in Bolivia, calls attention to the circumstance that, owing to the present high price of coal and other fuel material in Bolivia, there is every prospect that greater use will be made in the future of the abundant waterfalls and rivers for electrical purposes.

New Outdoor Fixtures.

The Elmer P. Morris Company, New York, N. Y., well known as manufacturers of fixtures and specialties for outdoor lighting, has completed a line of ornamental brackets for tungsten lighting which are worthy of note.

FIG. 1.—DESIGN NO. 39,702.

The illustrations given herewith show the results of the company's work in endeavoring to provide substantial fixtures of handsome appearance.

In design No. 39702 shown in Fig. 1 the wires are completely enclosed, and the lamps may be series or multiple. In the type shown series lamps were used, and a large installation has been in use at Hartford, Conn., for over a year.

Another type shown as design No. 39704 in Fig. 2, equipped for outside wiring, has been used at Mount Vernon, N. Y., and in New York City. On both types standard twenty-inch radial wave reflectors are employed.

FIG. 2.—DESIGN NO. 39,704.

The old style goose-neck bracket with either steel or copper-hood deflector is shown in design No. 39767 Fig. 3. The insulators can be furnished as shown or in an upright position.

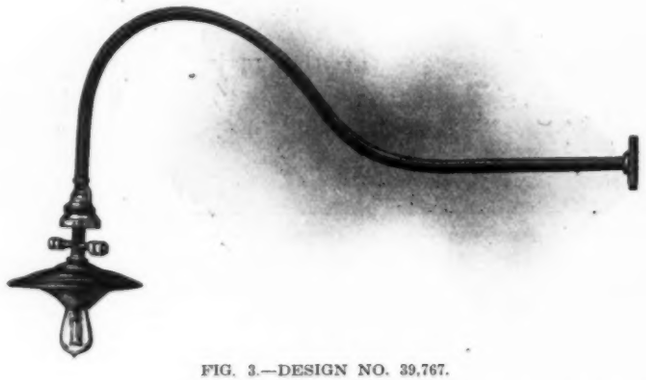


FIG. 3.—DESIGN NO. 39,767.

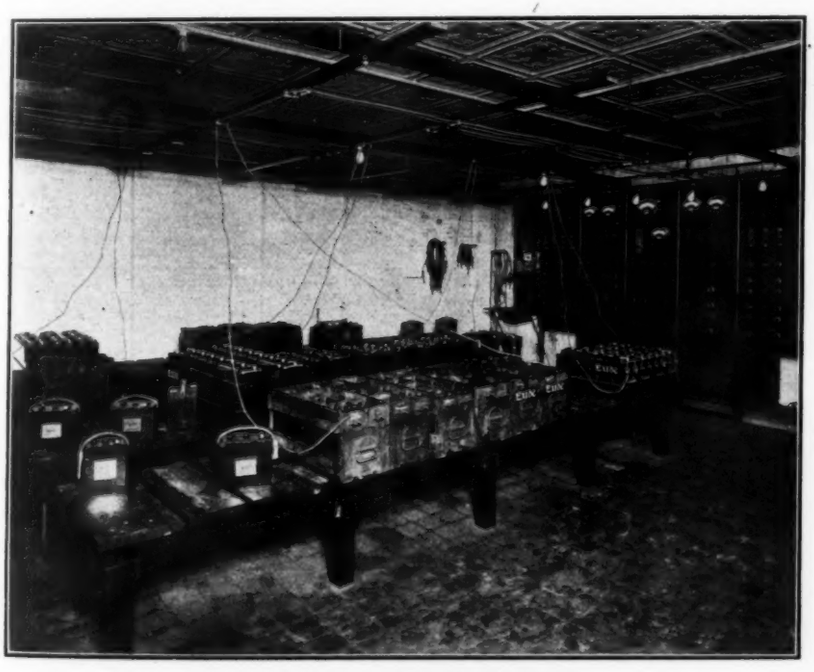
The various combinations should meet the requirements of almost any central station.

New Exide Battery Depot.

In 1902 the Electric Storage Battery Company opened its first Exide Depot in Boston, the object being to provide its customers with convenient facilities for securing batteries, battery parts and battery-expert attention, and this at the shortest possible notice, so that the time in which the car was out of commission would be reduced to a minimum. The depot has had the effect, also, of avoiding delay in transit as in the case of shipping direct from the factory to the customer, breakage in transit due to rough handling being entirely eliminated.

To meet the increased demand for Exide batteries in a manner mutually satisfactory to both the customer and itself, the Electric Storage Battery Company, during the early part of the year 1910, removed its Exide Depot to 789 Tremont Street, securing quarters sufficiently large to provide for the same proportional increase as in the past. The increase in floor space in the new quarters is 100 per cent; the increase in expert labor employed is 166 per cent; the increase in capacity of the new station is 125 per cent; the increase in stock carried is 150 per cent.

The storage or garaging of a car can be obtained in the same building. A view of the charging room is shown in the accompanying illustration.



INTERIOR OF EXIDE BATTERY DEPOT.

An Instantaneous Water Heater.

The accompanying view shows a new and useful device, recently placed on the market by the National Stamping & Electric Works, of Chicago, in the way of a portable, instantaneous water heater, simple and efficient in construction, neat and attractive in design and finish.

INSTANTANEOUS WATER HEATER.

The heater is finely finished in nickel and answers a long-felt want for instantly heating water in small quantities. It can be installed anywhere, is attached to an ordinary light socket and will operate on any lighting circuit with either direct or alternating current.

One of the features of this heater is that a small quantity of water is heated in less than one-half minute. The water does not come in contact with the heating elements, and is discharged perfectly pure and clean.

A Combined Safety and Slack Strap for Linemen.

The combined safety and slack strap, which has been devised by Mathias Klein & Sons, of Chicago, and which is here illustrated, is so arranged as to allow the lineman to work with a minimum of appliances.

While the ordinary safety belt allows the workman to work free-handed and in safety, he finds it necessary to use a comealong in connection with it. With this combined strap, slack wires may be pulled up as indicated in one of the accompanying illustrations. Another of the drawings shows the device as a safety strap, while the third shows the combination roller buckle.

VIEWS OF COMBINED SAFETY AND SLACK STRAP FOR LINEMEN.

It will be noticed that the free snap is of the roller type and the free end of the strap is guided by the roller buckle making a powerful pulling device. By throwing the tongue of the buckle into any one of the holes along the strap, the load can be held at any desired position.

A trolley clamp which was recently placed on the market by the Westinghouse Electric & Manufacturing Company embodies a number of quite radical improvements.

The swivel joint used permits the loss to be screwed up tight to the stud. This keeps out moisture and prevents corrosion and wear of threads. The two side caps are absolute duplicates so that the clamping pressure is always uniform.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 29.—At its weekly meeting on Tuesday, the London County Council, after a long discussion, sanctioned schemes for new tramways, the cost of which will amount to nearly $2,500,000. The cause of such a long debate was that in several parts of London tramways are strongly objected to, various Borough Councils exercising the veto which they possess, to obstruct the due development of tramways in London. On the other hand, the debate was still further lengthened by the complaints of a section of the Council that sufficiently rapid progress is not being made in "tramming" London. It was pointed out that whereas in Buenos Ayres the population is carried by the tramways 282 times in the year, in Glasgow, 222 times, and in Manchester 172 times, in London eighty-six was the figure. Undoubtedly the County Council is suffering severely at the hands of the Borough Councils which, in 1900, was given an absolute veto as to the method of traction which shall be adopted in their respective districts. Since those days the views of the Council have progressed towards a distinct liking for the overhead system, owing to the lower cost, but the Borough Councils think they ought all to be served alike and the expensive conduit system installed all over London. Apparently the County Council will be driven to appeal to Parliament to take away the veto given somewhat lightheartedly to the Borough Councils in the early days of London tramway development.

It is announced that the new telephone lines between Paris and London will be open for public use at the end of November, and that two others will be in operation next spring. With these lines in operation, it is expected that 400 conversations per day can be carried on. It is further announced that the Paris-Madrid telephone line, 900 miles long, will be ready by the end of 1911.

Edgar Allen & Company of London have just turned out a tramway layout 346 feet long for a tramway depot of the Leeds Corporation. It consists of twenty-seven tracks into the depot, each of thirty-five-foot radius from the main track.

The electric lighting of streets in London is again occupying public attention. In the City of London further experiments are being carried out with flame-arc lamps, the standards being placed in the center of the roadway in one experimental stretch and removed from the pathways. Not very far away, in Holborn, a good deal of the usual wrangling has been going on as to the relative merits of gas and electricity, and after almost deciding in favor of gas, the Council has been influenced by a deputation of large shopkeepers. The result is that a competitive experiment is to be carried out, side by side, in one important thoroughfare, by the gas and electric lighting companies. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 8, 1910.—We are now able to give some additional details about the new central stations which are to be built for the supply of Paris, according to the contract which was passed between the City and the new company known as the Compagnie Parisienne. This company is formed of the United electric plants and the Schneider-Wilde syndicate. The construction of the new sections will be commenced very shortly, and one of them will be located at the suburb of St., Ouen and the second at Issy. The same kind of groups will be used for both these plants and orders have been already placed for them. Such groups consist of a steam turbine coupled to a two-phase 10,000-kilowatt alternator working at 12,300 volts. On the same shaft are mounted two 220-volt direct-current generators for exciting and station circuits. Five of the turbines are of the Brown-Boveri type and these five groups have been ordered from two leading French electrical works.

An electric railroad is to be built in order to connect Toulouse with the town of Mazanet. The line will be about sixty miles long and it is expected to run high-speed express trains upon it, under favorable circumstances, owing to the fact that it runs for most of the way upon property lying off the main roads. I note the project for substituting electric for steam traction upon the road which runs from Tours to Vouvray.

In Switzerland the construction of electric railroads and tramways is very active at present, and there are no less than thirty-eight lines or branches building. Of these, nineteen were commenced last year. Among them we note the St. Fiden-Romanshorn electric railroad, in the region of Lake Constance, and the roadway upon this line is nearly finished. It is expected that the road will be opened for traffic before the end of this year. In the same region is the St. Gall-Wattwill electric road, which is also nearly completed. It contains the Wasserfiuh tunnel of 3,949 meters length and the 120-meter Sitter viaduct. On the Martigny-Orsières line in the Rhone Valley region, the part between Martigny and Sembrancher is finished for the most part, and it is expected to open the line for traffic next summer.

A power plant is to be built in order to furnish current for the town of Alt-Rohlau in the Karlsbad district of Austria, and the principal towns in the region. The contract has been passed between the municipality and the Sodauer Kohlen Company to this effect, and the agreement lasts for fifteen years. An electric road will be built in order to make connection with the Szentendre station of the Budapest Railroad and Visegrad. A. DE C.

CANADA.

(Special Correspondence.)

OTTAWA, NOVEMBER 5.—It is said that the question of the "All-Red" cable route between Great Britain and her overseas dominions, is likely to become acute in the near future. It will probably be brought before the British public by the discovery that the present Atlantic cables have passed into the hands of a great American trust.

Among the many subjects of legislation which the City of Toronto will present before the provincial legislature, at its coming session, is a bill providing for the purchase by the provincial government of the Bell Telephone Company.

The slogan finally adopted by the Publicity Committee of the city of Ottawa is "More power than Niagara, at less cost." This will be used on the committee's advertisements, booklets and stationery.

At a recent meeting of the directors of the Quebec Railway & Power Company, held at Montreal, satisfactory reports as to the Company's progress were submitted by the officials. It was shown that the Company's stock was being taken up, in a gratifying manner, by investors in France, and there were favorable prospects of an active market for it on the Paris Bourse.

The Electric Company, of London, Ont., has submitted a proposition to the City Council, offering to sell out on arbitration on any reasonable basis. The proposal refers to the opinion expressed by Sir Jas. Whitney, premier of Ontario, that it would be wise for the City and the Company to come to some agreement.

It is reported that, as the Canadian Light & Power interests have now obtained control of the Montreal Street Railway, an effort will be made to purchase control of the Shawinigan Water and Power Company, so as to strengthen the Canadian Company's position in the city of Montreal. It is estimated that it would cost little more than $5,000,000 to get control of Shawinigan and secure the necessary majority of shares. W.

MEXICO.

(Special Correspondence.)

MEXICO CITY, NOVEMBER 5.—The Graybill Industrial College of Montemorelos has just finished the installation of an electric power plant. J. R. Lowe is mechanical engineer of the college.

Miguel Taboada and Eduardo Soto, of Pachuca, are having plans prepared for the erection of a large hydroelectric plant on the Laguna de Zupitlan. Transmission lines will be constructed to mining districts and industrial centers of that section.

It is announced that the transmission line that is being constructed from electric power plant of the Copper Queen Mining and Smelting Company at Douglas to El Tigre, a distance of about fifty miles, will be finished and delivering power to the mines and reduction mills of this district by May 1, 1911.

Good progress is being made in the installation of the 12,000-horsepower hydroelectric plant for the Chapala Hydroelectric and Irrigation Company on the Santiago River, near Guadalajara. The construction of the transmission lines into the mining camps of Hostotipaquilla, Etzatlan and other sections of Western Jalisco is also being pushed forward rapidly. It is expected that there will be a large revival in mining operation in that region when the electric power is available for use in operating the machinery of the different properties.

Olaf Wenstrom has applied to the Federal Government for a concession for the use of water of the Montezuma River for the operation of a hydroelectric plant that he will install thereon.

What is said to be the longest electric power transmission line in Mexico has just been finished by the Central Mexico Light and Power Company, which is a subsidiary concern of the Guanajuato Light and Power Company. It runs from the distributing station at Guanajuato to the city of San Luis Potosi, and, counting the distance from the distributing station to the hydroelectric plant of the Company at El Duro, State of Michoacan, it has a total length of about two hundred miles. The new line will provide power for the large smelter at San Luis Potosi and for other industries of that city and adjacent territory. D.

COMMISSION NEWS FROM GEORGIA.

(Special Correspondence.)

The Railroad Commission of Georgia on November 4, heard the application of the Georgia Power Company for the right to issue $10,000,000 5-per-cent bonds and $10,000,000 of common stock. The Commission heretofore approved an issue aggregating $6,000,000 of bonds, $3,000,000 of common stock and $3,000,000 of preferred stock. The financial arrangements in contemplation at the time this issue was approved were not completed and the Georgia Power Company has now made financial arrangements for the development of its entire property. The mortgage under which the $6,000,000 of bonds was approved had a possible limit of $20,000,000 as the total issue. The mortgage under which the bonds were asked for the recent hearing limits the issue to $10,000,000 so that when all of the properties are developed and the plan is worked out the present mortgage will only be for half the amount the provisions of the former mortgage would have permitted C. Elmer Smith, president of the Georgia Power Company and a corps of prominent engineers testified before the Commission. The plan of development under which these bonds are sought contemplates the development of a number of properties on the Chattahoochee, Etowah and Tallulah Rivers. The maps presented to the Commission showed the watersheds of the Chattahoochee, the Etowah and the Tallulah Rivers and exhibited the distribution system which this development involves. It will reach all the cities from Toccoa on the east to Lagrange and Greenville on the west side of the State, and from Winder, Monroe and contiguous cities on the south to Rome, Cedartown and Cartersville on the north. It is a connected development, each plant supplementing the other, so that any accident interfering with the supply at one plant, will, when the development is completed, be immediately supplied from some other plant in the system. In connection with this hearing an application for $1,370,000 bonds and $50,000 stock was made by the Blue Ridge Electric Company. It was explained that this last named company was to be a mere holding company and that as the development of the Georgia Power Company goes forward the bonds issued by the latter company will be paid off and the properties pass into the Georgia Power Company so that when the development is completed there will be only one company, the Georgia Power Company with $10,000,000 of stock and $10,000,000 of bonds.

COMMISSION NEWS FROM NEW JERSEY.

(Special Correspondence.)

The Board of Public Utility Commissioners for the State of New Jersey has issued a certificate of approval of a proposed issue by the Crosswicks Water Company of capital stock to the amount of $7,500 and of bonds to a like amount.

The Board has approved of an ordinance of the Town of West Orange granting permission to the Public Service Railway Company to construct and operate so much of a connection between the southerly track of the Public Service Railway Company's street railway in Main Street and track on private right of way south of Main Street, as lies within West Orange.

The Board has also approved an ordinance of the Town of West Orange granting to the public Service Railway Company the right to construct and operate street railway connections between the single track in Harrison Avenue and the single track in Eagle Rock Avenue, in the Town of West Orange.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TWO NEW RAILWAYS IN ALABAMA.—Papers have been filed with the Secretary of State reporting the incorporation of the Alabama Traction Company, a new street railway that will operate in Montgomery. The new traction company is capitalized at $1,000,000, of which amount $250,000 has been paid into the treasury. The officers of the Company are: President, Charles G. Abercrombie, of Montgomery; vice-president, Charles F. Woodward, of Wakefield, Mass.; secretary and treasurer, John J. Flowers, of Montgomery. The stockholders are named as Charles G. Abercrombie, Charles F. Woodward, John J. Flowers, Henry M. Hobbie, of Montgomery, and B. Frank, of Montgomery. The Company will operate a street railway over certain streets in the city and will also operate two interurban lines, one connecting this city with Prattville, Ala., a distance of fifteen miles, and the other extending to Wetumpka, Ala., a distance of twenty miles. An amusement park is scheduled as one of the features to be put into operation by the new street railway.

Birmingham will have a new street railway line. It will extend from the western terminus of the Wylam line to the Tennessee Company's new mine No. 13, which is one mile beyond Gary-Ensley. Articles of incorporation of the new company will be filed just as soon as Birmingham grants a franchise for some ten or eleven miles of the city's streets. The County Board of Revenue has already granted a right of way for all the territory asked for from the city's limits at Hobson along the Gary-Ensley road, thence west to the Tennessee Company's mines. The purpose of the new railroad will be to develop the western part of Birmingham. The new road will cost about $50,000, all of which money is said to be in hand. The name of the new line will be the Alabama Railway & Electric Company.

LIGHTING AND POWER.

(Special Correspondence.)

ELLIOTT, IOWA.—R. O. Prather proposes to install an electric light plant at this point. P.

AINSWORTH, NEB.—The Ainsworth Electric & Power Company will put in a line to Lone Pine. P

WETNER, KANS.—This city has voted bonds for $6,000 for the establishment of an electric light plant. P

HURON, S. D.—An electrical expert will be employed by the city to investigate the street lighting question. C.

CLARKSVILLE, TEX.—The Clarksville Light Company is about to rebuild its plant recently damaged by fire. P.

WARREN, ARK.—The Warren Light and Water Company has increased its capital stock from $20,000 to $50,000. P.

LIVE OAK, CAL.—The Live Oak & Encinal Electric Light Company is preparing to extend its line north of Live Oak.

WILTON, WIS.—The Wilton Light & Power Company has been granted a franchise for the installation of a light and power plant in this city. C.

NEWPORT, CAL.—The city authorities here will offer for sale on December 12 an electric lighting franchise covering the streets and alleys of Newport.

CHINOOK, MONT.—A. S. Lohman, Thos, O'Hanlon and W. H. Duke have been appointed a citizens' committee to secure the construction of an electric-light plant. C.

DUBLIN, GA.—This city will vote on December 6 on the issuance of $25,000 in bonds for the improvement of the lighting plant and the extension of sewers.

DECATUR, ILL.—Powers Bros. will add a new 150-horsepower boiler to the power equipment in the plant of the Powers Block giving it a capacity of 390 horsepower. Z.

LOGAN, IOWA.—The Omaha Bullock Public Service Company has been incorporated here with a capital stock of $10,000 by W. N. Brassington, C. J. Stoneham and G. D. Snyder.

BLOOMER, WIS.—Power for the electric light plant of this place is to be furnished by the Chippewa Valley Railway and Light Company. The plant is owned by Martin Rasmus. M.

PEORIA, ILL.—After erecting a new $8,000 addition to its building the Union Brewing Company will change its motive power for its big brewing plant from steam to electricity. Z.

STANDARD, ILL.—The Berry Coal Company is having its mine electrified, securing power from the plant at Granville, Ill. The village is now lighted by the plant at Granville. Z.

FOREST GROVE, ORE.—A. Q. Welch, of Portland, Ore., has been granted a twenty-five-year franchise for the transmission of power and electricity along certain streets of this city.

SYRACUSE, N. Y.—The 300 block in South Salina Street is to be equipped with ornamental lights. When this has been done it is expected that considerable extension will follow.

GRAND LEDGE, MICH.—The Commonwealth Power Company has begun the work of rebuilding its entire lighting system in this city. An ornamental lighting system is to be installed.

ALAMEDA, CAL.—It is expected that a new building will soon replace the municipal electric plant on Park Street of this city. For this purpose $12,000 has been voted by the City Council.

CHEHALIS, WASH.—The Twin City Light & Traction Company has succeeded in floating bonds to the amount of $150,000, the fund to be used in erecting a power house and other improvements.

WEBSTER CITY, IA.—This city is to have a power station which will be erected at a cost of $50,000. The entire equipment, with the exception of the water softener and one switchboard, will be new.

CRAWFORD FALLS, IDA.—L. A. and N. E. Wayland, who are putting in a power plant here, have signed a contract to put in a plant at Tamarack early next year for a company which is now being formed. A.

MACON, GA.— It is announced that the power lines of the Central Georgia Power Company have been completed from the power house at Jackson to this city. The power is to be transmitted at 60,000 volts. B.

LOS ANGELES, CAL.—The Pacific Ocean Power Company has purchased the electric light plant here. In addition to supplying the local consumers, Blair, Neb., and Magnolia, Iowa, will be given twenty-four hour service. Z.

REDMOND, ORE.—The Crook County Water, Light & Power Company of this city has purchased the Cline Fall Power Company holdings, the purchase price being given as $55,000. An additional plant will be installed early next year.

BRAINERD, MINN.—The Toltz Engineering, St. Paul, Minn., has been awarded a ten-year contract to furnish the city with current. Machinery has been ordered and it is expected to have the plant in running order by December 1. C.

DOVER, DEL.—The American Light, Heat and Power Company has been chartered with a capital of $15,000,000. The Dela-

ware incorporators are Warren N. Akers, William J. Maloney and Millard C. Taylor, all of Wilmington.

LIVINGSTON, TEX.—The Livingston Manufacturing Company has increased its capital stock from $2,000 to $15,000 and will make improvements to its electric light plant here. The Company was formerly called the Livingston Light Company. D.

CAMPBELLSPORT, WIS.—A new electric light plant is to be erected at this place by a party of Milwaukee men, who recently purchased the present plant from Richard Thomas of Milwaukee. The new plant will be erected on the site of the old one. M.

CLYDE, N. Y.—The local electric light and gas plants which have lain idle for some eight or ten years are being rebuilt so that in the spring new machinery will be installed for the purpose of supplying the village and vicinity with electricity and gas.

LONDON MILLS, ILL.—The Farmington Electric Light Company has closed a contract to light the streets of London Mills and to sell current for commercial purposes giving twenty-four-hour service. A line will soon be strung from the power plant at that place. Z.

ELKHART, IND.—A committee from the Elkhart Industrial Association has been named to secure figures on decorative lighting schemes both by electricity and gas. The members are City Engineer Smith, C. M. Lounsberry, J. L. Harman and Dr. C. K. Runyon. Z.

SPOKANE, WASH.—D. L. Huntington, president of the Washington Water Power Company, anounces that his company has purchased 7,000 acres of land north and west of the Nine Mile, on the Spokane River, and is planning to build an electric power plant. A.

KINGMAN, ARIZ.—The big power plant in Kingman, with its two units in operation, is destined to be one of the largest steam generating plants on the Pacific Coast. The third unit is now being constructed and will give the plant a capacity of 3,000 horsepower.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company has started work on a 10,000-volt line from its power station on Castillo Street to the sub-station in Montecito, which will cost $10,000. The company will also build a concrete station house. A.

OMAHA, NEB.—The Omaha & Western Iowa Traction Company, of Pierre, S. D., has been incorporated with a capital of $250,000 to construct a line to Sioux City, Iowa, by way of Council Bluffs, a distance of ninety miles. The cost of construction is estimated at $20,000 a mile. C.

HEMPSTEAD, TEX.—It is reported that this place will be electrically lighted throughout both the business and residential sections before the Christmas holidays. The power house has been practically completed, the wire lines surveyed and marked off and a 1,000-light plant has been purchased.

CLAYTON, N. M.—The electric lighting and water plants of this place owned by Robert Ervein of Santa Fe have been taken over by the municipality, and an election has been called to vote bonds to the amount of $50,000 for the purpose of rebuilding and extending the systems within the next year.

GARY, IND.—A. E. Knotts, is seeking a franchise to build and operate an electric light plant in this city. The United States Steel Corporation is now furnishing the City and private parties with current for light and power. If the franchise is granted it expected that competition will be strong. S.

OCEANSIDE, CAL.—E. V. Griffes, manager of the Oceanside Gas & Electric Company has been figuring on the cost of extending the Company's transmission system to the town of Fallbrook for the purpose of supplying light in that place. He states that the extension will probably be made at a cost of about $4,000.

CAMP HILL, ALA.—In a special election held here to decide on a bond issue for electric lights, the bond issue was carried. The town has an option on a water power on Sandy Creek, about seven miles away, which experts say will develop from 150 to 600 horsepower. It is said the light plant can be installed in ninety days.

EVANSVILLE, IND.—There is a bitter rivalry between the New Public Service Company and the old Gas & Light Company to secure and control the contracts for subscription lighting on the principle streets. Mayor Heilman refuses to interfere further than to look after the uniformity of the lamp standards to be put in. S.

REDDING, CAL.—The Mount Shasta Power Company is building a tunnel six and one-half miles long for conveying water from the Pit River to Montgomery Creek. It is estimated that the time required to complete the tunnel will be from eighteen to twenty months. The fall of the water from the place of its entrance to the tunnel outlet will be 800 feet. A.

MILLEDGEVILLE, GA.—The Central of Georgia Guano Company and Baldwin County Fertilizer Company will be operated entirely by electricity when completed, which will be about December 1. Power will be furnished from Oconee Mills, electric department. Milledgeville has already an electric cotton ginnery, which was one of the first established in Georgia.

KEEWATIN, MINN.—At a special election held in this village, the ballot was unanimous in favor of installing an electric light plant and powerhouse. An ornamental lighting system will also be placed along the business streets, and bids have been called for the erection of the necessary buildings and equipment. At the present time the illumination is by gas, generated from gasoline.

ATLANTA, GA.—The Blue Ridge Power Company, incorporated in Hall County, Ga., has applied to the Railroad Commission of Georgia for permission to issue $50,000 of stock and $1,375,000 in bonds. The Wofford Shoals Light & Power Company, at the same time asks permission to issue $70,000 of stock and $100,000 in bonds. This latter corporation is a Habersham County, Ga., property.

MOLINE, ILL.—Farmers on the Rock River bottoms will drain several thousand acres of land by means of electrically-operated pumps at stations located on dykes along the river banks. Dr. A. H. Arp, one of the men interested, is at present plowing with gasolene motors but intends later to use electricity for this purpose. Current will be sold from the river stations to the farmers in the vicinity. Z.

JACKSON, GA.—The concrete work on the big dam on the Ocmulgee River of the Central Georgia Power Company is about completed. The powerhouse and turbines are in place and the transmission lines have been completed to Macon. The work of filling up the fifteen-mile reservoir will soon be started. It is said that it will require three weeks at the usual flow of the river for the basin to fill up. B.

TALLADEGA, ALA.—The power line of the Alabama Power & Development Company to Jackson Shoals and thence to Talladega is about completed. Power at Jackson Shoals will be generated for Anniston and Talladega, Ala. The plant at Anniston will be operated meanwhile, supplying power for industrial purposes both for that city and Talladega. After the plant at Jackson Shoals is operating, the Anniston plant will become a reserve one.

KAUKAUNA, WIS.—The Wisconsin Railroad Commission has ordered the Kaukauna Gas, Electric Light & Power Company, of Kaukauna, to make improvements to its plant which shall cost not less than $15,000, repairing and enlarging its plant so that it will give adequate service. It was stated in the complaint that the city was placed in total darkness on numerous occasions by breakdowns at the plant. The Company is given three months in which to do the work. M.

FORT WORTH, TEX.—Through an agreement recently made between J. R. Nutt, of Cleveland, O., and the city commission, a $2,000,000 electric power plant will be immediately constructed here. Through the agreement Mr. Nutt and associates, a group of capitalists who finished the Fort Worth-Dallas interurban, are to reduce the cost of electric lights to about one-half the present rate, put all wires downtown underground and give the City gratis ornamental iron poles on the business streets to the amount of $75,000.

OELWEIN, IOWA.—The plant of the Oelwein Light, Heat and Power Company has been sold to a Chicago company. Officers of the new concern are: President, R. W. Saunders; vice-president, T. T. Watson; secretary, W. J. Candish; all of Chicago; treasurer, C. B. Chambers, Oelwein and directors A. Hanson and J. H. Kerwin of Oelwein. Construction of a new fireproof building for the plant, installation of ice-making machinery and introduction of the curb system of decorative lighting in Oelwein are among the plans of the owners. Z.

FRESNO, CAL.—The San Joaquin Light & Power Company, with headquarters in this city, is preparing to extend its transmission system through the oil fields of Kern County. A loop will be run from Fresno to Bakersfield, returning via the oil city of Goalinga to the power plant near Fresno. Work will be begun at once at Fresno and Bakersfield. This will connect four plants of the Company, a 27,000-horsepower plant near Fresno, a 2,500-horsepower plant in that city, a 2,000-horsepower plant outside of Bakersfield and a 2,500-horsepower plant in that city.

PROVIDENCE, R. I.—Announcement has been made that the Rhode Island Company is to double the capacity of its Manchester Street power station and that $300,000 will be expended in the work. The new steam turbine to be installed will have a normal capacity of 13,500 horsepower and a maximum capacity of 20,000 horsepower. The exterior of the building will not be changed except where new machinery will be installed for unloading coal. Besides the 20,000 horsepower turbine the improvements include a condenser, switchboard-panels, and three 200-kilowatt rotary converters.

MANTON, CAL.—J. G. Cochrane, the engineer in charge of the work being done by the Northern California Power Company at Eagle Camp on North Battle Creek, three miles below here, announces that the construction work is very nearly finished. A dam sixty-five feet wide and ten feet high has been constructed. A total of 1,325 feet of tunneling has been drilled. There are six of the tunnels, being respectively 100 feet, 110 feet, 390 feet, 160 feet, 391 feet and 165 feet in length. There are 3,674 feet of flumes carrying 2,000 inches of water which will empty into the Inskip ditch for the purpose of generating power at the Inskip power house, two and one-half miles below. This work has been accomplished during the last five months.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LAKE GENEVA, WIS.—The Badger Railway & Light Company has been incorporated to build an electric line to Whitewater. P.

SACRAMENTO, CAL.—The Northern Electric Company, operating electric railways out of this city, has applied for additional franchises which will practically enable it to encircle the city. A.

TAYLOR, TEX.—The construction of an electric belt railway to connect the different industrial plants and steam railroads of Taylor is being promoted by L. E. Walker, president of the Quanah, Seymour, Dublin & Rockport Railroad. D.

VISALIA, CAL.—The Visalia Electric Railway Company has started work on the branch to Woodlake and expects to finish it by the latter part of November. The branch, starting from Bravo Lake station, will be about three miles in length.

LOS ANGELES, CAL.—The Pacific Electric Railway Company of this city has adopted sketches for a new passenger station at Pine Street and Seaside Boulevard, Long Beach. The construction will be of steel and brick on a concrete foundation. A.

DALLAS, TEX.—The Trinity Valley Traction Company will finish the survey for the proposed interurban electric railway that it will construct between Dallas and Palestine, about one hundred miles, by December 1. The route runs through Corsicana and a number of other important towns. D.

BELLINGHAM, WASH.—The franchise of Stone & Webster has been approved and work on the Skagit-Bellingham interurban road will be commenced soon. The road will be thirty miles in length, running between Bellingham, Burlington, Mount Vernon and La Conner. It will cost $1,500,000.

BROWNSVILLE, TEX.—Theodore Stegner, of Kansas City, Mo., and associates will apply to the City Council for a franchise to construct an electric light and power plant and an electric street railway system here. He says that if the franchise is granted immediate steps towards starting work on the improvements will be taken. D.

LIMA, O.—The new $100,000 interurban station of the Ohio Electric Railway Company was recently opened for business. The upper floors of the building are given over to executive offices and dispatchers. The station occupies nearly a city block in the heart of the commercial district. It was built in consideration of renewal of street franchises. H.

BEAUMONT, TEX.—Lynn H. Dinkins, of New Orleans, president of the Beaumont Traction Company, has notified the City Council of Beaumont that the franchise that was recently granted that company for its proposed system of electric railway will not be accepted. The chief objection is against the clause requiring the company to light the streets occupied by its lines. D.

FRESNO, CAL.—S. N. Griffith is preparing to build an electric railroad between here and Clovis, Cal. He announces that he has secured three-quarters of the right of way and that construction work will commence as soon as he has secured the other one-fourth. Mr. Griffith expects the Clovis enterprise to cost complete about $2,000,000. The expense of construction he figures at $30,000 per mile.

OAKLAND, CAL.—The Oakland Traction Company, operating all of the electric street railways in this and adjoining cities, has applied for five additional franchises in this city, largely in the down town district. The total length of the franchises asked for does not exceed four or five miles, but they form important connections which are needed in view of large improvements contemplated. A.

MADISON, WIS.—The Janesville Traction Company, capitalized at $125,000, has filed articles of incorporation here. The incorporators are Thomas S. Nolan, William Murphy and Jennie L. Burke. The purpose of the company is to operate the Janesville street railway system, which it recently purchased from the old electric railway company. Extensive improvements will be made, the whole system to be practically rebuilt, it is announced. M.

MINNEAPOLIS, MINN.—Officials of the Electric Short Line expect to have cars in operation to Medicine Lake, the winter terminus, by November 15. Grading is done for a double track and the additional rails are to be laid later. Grading will start again next spring out of Minnetonka and Watertown. W. L. Luce, one of the heavy stockholders expects to install a hydroelectric plant four miles from this city and secure power for lighting the park district at Twin Lakes. Z.

SALEM, ORE.—The Santrain Development Company has applied for a franchise over the principal streets of this place and proposes to have an electric line between Salem and Stayton in operation within two years. The line, when completed, will give a direct communication with the eastern section of the Williamette Valley, one of the richest communities in the state, reached now only by the Springfield branch of the Southern Pacific system and not readily accessible to Salem.

AURORA, ILL.—Stockholders of the Fox Illinois Union Railway Company have elected the following directors: H. H. Evans, John Meredith, Joshua Rhodes, Frank Zimmerman and Ralph Putnam. Officers were elected by the directors as follows: President, H. H. Evans; vice-president, John Meredith; secretary, R. C. Putnam, and treasurer, Frank M. Zimmerman. Present plans call only for building an electric road from Yorkville to Morris with connecting lines to Dwight and Sandwich. Z.

LOS ANGELES, CAL.—On October 31 the Los Angeles Railway Corporation, which recently succeeded the Los Angeles Railway Company with an increase of capitalization from $6,000,000 to $20,000,000, bought out all the city lines and the entire city equipment of the Pacific Electric Railway Company at a price said to be in the neighborhood of $12,000,000. It is understood that H. E. Huntington will continue as the active manager of the Company, with the Huntington and Southern Pacific Railway interests owning half of the stock each.

BIRMINGHAM, ALA.—Incorporators R. W. Snyder, Max Blach, Joseph Martin, W. W. Crawford, W. A. Spencer, W. J. Stacy, T. P. Frierson et al under the name of the Alabama Railway and Electric Company are applying to the City Council for franchise. If the franchise over certain streets in the Wylam section of Birmingham is granted by the City, the construction of the new line running from the western terminus of the Wylam line of the Birmingham Railway Light & Power Company to the new No. 13 coal mine of the Tennessee Coal, Iron & Railroad Company will be under way within a few weeks.

PIERRE, S. D.—Articles of incorporation have been filed for the Omaha & Western Iowa Traction Company, with nominal headquarters at Pierre, and a branch office for the transaction of business at Omaha. The capital is $250,000, and the incorporators, C. E. Brown, M. E. Gallian, C. Desmond McDonough, Daniel J. Avery, of Chicago; Jas. S. Sebree, Pierre. The purpose of the corporation as set out in the articles is the construction of a line of railways from Omaha, by way of Council Bluffs to Sioux City, a distance of ninety miles, at an estimated cost of $20,000 a mile, the line to operate in the counties of Harrison, Monona and Woodbury, in Iowa.

YORK, PA.—A new trolley line to connect with Baltimore is the latest project. The latest survey was made by the Pittsburg Bonding firm and the proposed route is by way of Glen Rock, Paradise, and Logansville. L. H. Roberts, of New York, representing the Tennis Company, of Pittsburg, is trying to interest capitalists in the proposition and $275,000 will be guaranteed to start the road. The line will be extended to New Freedom, which is thirty-five miles from Baltimore. For several years there has been a movement on hand to reach Baltimore by way of trolley. It looks now as if the project would go through. But few bridges and cuts are needed over the proposed route.

BIRMINGHAM, ALA.—Provided the city council grants the extension of the city franchises asked for, actual construction work on the lines of the Tidewater Railroad Company will probably begin within sixty days, according to a statement made by J. M. Dewberry, president. The first work will be the construction of forty-six miles of track connecting East Lake and Bessemer after which the main line to Tuscaloosa will be built. The cost of the work within the Birmingham city limits will approximate $2,500,000 and include freight and passenger terminals. It is stated that the banking firm of Morris Brothers of New York, Philadephia etc., is behind the project and that all financial arrangements have been completed.

ASHEVILLE, N. C.—Those interested in the building of the Isothermal Traction Company's electric line from Gastonia, on the Southern Railway, to Asheville, in the heart of the Appalachian Mountains of western North Carolina, have secured the funds necessary for making the necessary survey and for procuring the right of way from Asheville to Rutherfordton, about midway on the Seaboard Air Line's Carolina central division to the western part of the state. Geo. L. McKay, of New York, is one of the chief promotors of the new line, which will penetrate an almost untapped section of the rich mountain region above Rutherfordton, at the same time reaching numerous large cotton mill villages in the Piedmont section of the Carolinas. The total length of the proposed route will be about 100 miles. L.

AUSTIN, TEX.—The plans for the construction of an interurban electric railway between Austin and San Antonio and having branch lines to Lockhart, Luling and Seguin are taking definite shape. Vories P. Brown of San Antonio, one of the promoters of the project, announces that the formal organization of the company will soon be completed and a charter applied for. The company will have a capital stock of $2,000,000. Engineers who have gone over the route of the proposed line between this city and San Antonio estimate that the cost of its construction will be approximately $1,500,000, exclusive of the power plant. The main line will be about eighty-five miles long and will traverse a territory that is thickly populated with prosperous farmers. On the route are the towns of Manchaca, Buda, Kyle, San Marcos, Hunter, New Braunfels, Davenport and other smaller places. The proposed branch lines will have an aggregate of about sixty miles of track. In the matter of power for operating the system tentative plans contemplate the use of electrical energy from the large hydroelectric plant that is being installed near Marble Falls. The primary object of the latter plant is to furnish electric power for electric railways and industrial enterprises in the territory within a radius of 150 miles of Marble Falls. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MANCHESTER, IOWA.—The Delaware County Telephone Company is rebuilding its lines at Ryan. Z.

HEWITT, OKLA.—The Darling Telephone Company has been incorporated with a capital stock of $3,000. P.

HOUSTON, TENN.—The Houston County Telephone and Telegraph Company has been incorporated with a capital of $5,000.

RAVENDEN SPRINGS, ARK.—The Mutual Telephone Company has been organized to construct a line from this point to Imboden. P.

SULLIVAN, ILL.—The stockholders of the Sullivan Mutual Telephone Company have sold the local exchange to H. S. Hankins, of Decatur for $20,000. Z.

PINE GROVE, MONT.—The Pine Grove and Grand View Telephone Company has been incorporated with a capital of $5,000. The incorporators are F. C. Blair, E. L. Hoffer and A. D. Letroult.

MARLINTON, W. VA.—Ronceverter & Elkins Telephone Company has been incorporated with a capital of $50,000. The incorporators are Homer N. Hutchinson, H. E. Nease, T. L. Burdette and B. F. Williams.

ATHENS, GA.—Three new telephone lines for the use of farmers living in the vicinity of Athens have been put in operation and according to the Southern Bell authorities there is a greatly increasing demand here. B.

PORTLAND, ME.—The new building to be erected by the New England Telephone and Telegraph Company is to be constructed with the greatest possible speed. The exchange will serve upward of 8,300 subscribers.

IPAVA, ILL.—The Ipava-Summum Telephone Company has elected the following officers: President, O. P. Weese; secretary, B. F. Bricker; treasurer, Nicholas Weber; trustees, H. O. Robinson, E. H. Diehl and Claude Danner. Z.

SEATTLE, WASH.—It is reported that wireless telephone service will soon be installed between Seattle and Tacoma. The Commercial Wireless Manufacturing Company has been formed to build wireless telephone apparatus.

APPLETON, WIS.—The Wisconsin Telephone Company is planning to make extensive improvements on its local exchange and system, amounting to about $300,000. A new exchange building will probably be erected and other improvements made. M.

TEMPLE, TEX.—The Bell County Telephone Company is installing a new switchboard, with 2,000 drops. The Company is making other extensive improvements. It recently took a twenty-five-year lease on a business building here which it is now fitting up for its local headquarters. D.

DANVILLE, ILL.—The Vermilion County Telephone Company has presented to the City Council a request for a franchise proposing to share profits with the municipality if allowed to increase its rental rates. An alternative is that the city may reduce the rate if experience shows the advance was not needed. Z.

BEMIDJI, MINN.—This town is to have a new independent telephone company if its request of the City Council for permission to install a system here is granted. The new company is known as the Red Lake Valley Telephone Company, of which W. R. Mackenzie, secretary of the Northern Minnesota Development Association, is president, and J. H. Grant, secretary.

SAN MARCOS, TEX.—The San Marcos Telephone Company has begun the work of extending its lines and otherwise improving its system here. An entirely new pole and cable system will be established and a new exchange equipment installed. The new system will be sufficient to accommodate 600 telephone subscribers. The company was recently reorganized and passed into the hands of local citizens. D.

PECOS, TEX.—The Reeves County Telephone Company will rebuild a large part of its long-distance telephone system in Reeves County and make extensive improvements to its telephone system in Pecos. This company operates exchanges at Pecos, Saragosa, Balmorhea, Barstow, Toyah and other places. In addition to the long distance system in this county it has a line extending to Fort Stockton in Pecos County. D.

LITTLE ROCK, ARK.—The Rice Belt Telephone Company, capitalized at $25,000, of which $10,000 has been subscribed, has secured a charter from the Secretary of State. The headquarters of the Company will be at Waldenburg, Poinsett County, and from that point it will construct telephone lines throughout the rice belt in that part of the state. The incorporators of the company are C. E. Lashbrook, president and secretary; W. E. Buss, vice-president; A. M. Lashbrook, treasurer.

EPWORTH, IOWA.—The Epworth Telephone Company has been formed here with the following officers: President, G. E. Langham; secretary, C. B. Hanna; treasurer, J. M. Maxwell; directors, M. LaShorne, S. E. Edwards and E. M. Silker. The company will operate an exchange here connecting with rural lines. A new rural line known as the Kidder Valley Telephone Company has been formed with the following officers: President, Z. Kidder; vice-president, Albert Oberfoel; secretary, Samuel Strief; treasurer, John Miller; directors, Theodore Beresford, Paul Smith and Peter Reinsbach. Z.

ELECTRICAL SECURITIES.

In spite of the expected disturbance before election, prices were steady, and the general trend of values was decidedly upward. This is attributed to the general expectation that the outcome of the election will be favorable to business interests. The three leading stocks, Steel, Reading and Union Pacific, furnished sixty per cent of the week's trading, advancing an average of two and one-half points. Total sales were 2,512,543 shares, comparing with 3,361,050 in the previous week. Substantial orders for steel rails have been reported by the railroads and the outlook for the steel business is good. Copper was purchased at advancing prices. Money is easy both here and abroad, and the banks are carrying considerably larger surplus than a year ago.

Northwestern Elevated's October daily traffic increased 6,119, or five per cent over last year.

The Massachusetts Lighting Company reports gross for September of $74,439, an increse of $2,514 over September, 1909.

At the Allis-Chalmers annual meeting Frank O. Wetmore was elected a director to succeed William W. Allis, retired. Other directors were re-elected.

The St. Joseph & Savannah Interurban Railway Company has certified to the Secretary of State that it has increased its capital stock from $350,000 to $2,000,000.

Henry L. Doherty & Company are offering at par, with a bonus of $350,000 of common stock, $1,000,000 six per cent cumulative preferred stock of the Cities Service Company, the $50,000,000 holding concern organized recently to control gas and electric properties in various cities in the United States. It is announced that both the preferred and common stock will pay quarterly dividends from October 1 at the rate of six per cent and three per cent respectively, so that the yield on subscribers' allotments will be over seven per cent.

DIVIDENDS.

Chicago Telephone Company, regular dividend of two per cent, payable December 31 to stock of record December 28. Books close December 28 to January 3.

Federal Light and Traction Company, regular quarterly dividend of one and one-half per cent on the preferred stock, payable December 1, to stock of record November 15. Books close November 15 and reopen December 2.

National Carbon Company, regular quarterly dividend of one and three-quarters per cent on the preferred stock, payable November 15, to stock of record November 5. Books closed November 5 and reopen November 16.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.

	Nov. 7.	Oct. 31.
Allis-Chalmers common	9½	9
Allis-Chalmers preferred	34	32½
Amalgamated Copper	71⅛	68¾
American Tel. & Cable	84	84
American Tel. & Tel.	142⅝	140⅞
Brooklyn Rapid Transit	77⅝	77⅛
General Electric	154½	155
Interborough-Metropolitan common	22¼	22
Interborough-Metropolitan preferred	58⅜	57¾
Kings County Electric	123	123
Mackay Companies (Postal Telegraph and Cables) common	93	92
Mackay Companies (Postal Telegraph and Cables) prefrd.	75	73½
Manhattan Elevated	142½	142
Metropolitan Street Railway	*18	*18
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	41½	40½
U. S. Steel common	81	78¾
U. S. Steel preferred	118	119⅝
Western Union	72¼	72
Westinghouse common	73½	73½
Westinghouse preferred	120	120

*Last price quoted.

BOSTON.

	Nov. 7.	Oct. 31.
American Tel. & Tel.	142½	140⅜
Edison Elec. Illuminating	272	266
General Electric	154½	155
Massachusetts Electric common	20¼	19½
Massachusetts Electric preferred	85½	84¾
New England Telephone	136	133½
Western Tel. & Tel. common	17	17
Western Tel. & Tel. preferred	90	85

PHILADELPHIA.

	Nov. 7.	Oct. 31.
American Railways	42	43
Electric Company of America	11⅝	11⅝
Electric Storage Battery common	48	49
Electric Storage Battery preferred	48	49
Philadelphia Electric	15¼	15½
Philadelphia Rapid Transit	15⅜	16½
Philadelphia Traction	81	81
Union Traction	39	39½

CHICAGO.

	Nov. 7.	Oct. 31.
Chicago Railways, Series 1	76	77
Chicago Railways, Series 2	20½	19¼
Chicago Subway	5	5
Chicago Telephone	121	121
Commonwealth Edison	115⅝	115
Metropolitan Elevated common	20	20
Metropolitan Elevated preferred	65	62
National Carbon common	125	127
National Carbon preferred	118¾	118½

PERSONAL MENTION.

E. J. EDWARDS has joined the staff of the National Electric Lamp Association.

FRANCIS GRANGER, formerly with the Vulcan Electric Heating Company, Chicago, Ill., has resigned from that company, and has gone with the Millar Electric Company as its general manager.

J. H. LEARY, for many years chief dispatcher for the Southern Pacific Company at Oakland Mole, Cal., has been appointed superintendent of the Central California Traction Company with headquarters at Stockton, Cal.

L. P. SAWYER, secretary and treasurer of the Buckeye Electric Company, Cleveland, O., was a Chicago visitor last week. Mr. Sawyer and Mrs. Sawyer have been traveling in the West for the last six weeks and Mr. Sawyer returns to Cleveland greatly improved in health.

C. M. SEELEY, for twenty-three years with the Pacific Telephone & Telegraph Company and at present division commercial superintendent for the Company at Los Angeles, Cal., has resigned that position. He will be succeeded by J. W. Gilkyson, Los Angeles division superintendent.

JOSEPH E. LOCKWOOD, well known in early electric railway and electrical manufacturing history (at that time of Detroit, Mich.), is now general manager of the Yaryan Naval Stores Company, of Gulfport, Miss. Mr. Lockwood was a recent visitor to New York City, and renewed many old-time electrical acquaintances.

CHARLES H. BOYNTON, formerly general superintendent of the Associated Press, and recently a member of the New York Stock Exchange firm of Hay & Boynton, has formed a new partnership under the name of C. H. Boynton & Company, Mr. Hay remaining as a special instead of a general partner. Mr. Boynton has many friends in the electrical field and handles many electrical securities.

CLARENCE H. MACKAY, president of the Commercial Cable and Postal Telegraph Companies, has been one of the most active influences in the present production of grand opera in Chicago. Mr. Mackay, who is chairman of the board of directors of the Opera Company, signalized the great success of the opera premier on Thursday evening by a supper to fifteen guests including the leading members of the company on Friday. It is also understood that Mr. Mackay has arranged for every employee of the telegraph company in Chicago to attend some performance during the season in Chicago.

HARRY B. RAMEY has been appointed assistant general manager of the Robbins & Myers Company, of Springfield, O. Mr. Ramey is a graduate of the Washington High School of Washington, D. C., and afterwards graduated from the National University Law School in 1892. He entered the Government service as a special agent of the Interior Department and resigned January 1, 1902, and connected himself with the late E. W. Gilmer's interests at Warren, Ohio. He represented the Warren Electric & Specialty Company for a time in Indiana and Michigan, and later on became a general representative of this company. At the time the Peerless Electric Company was organized he became associated with that company as general representative, and resigned January 1, 1904, to become secretary and general manager of the Monarch Incandescent Lamp Company. He remained with this company until January, 1905, and resigned and accepted a position with the National Electric Lamp Association of Cleveland, O., as sales manager of the Economy Electric Company. He remained with this company, with headquarters at Warren, O., until January 1, 1907, when he resigned and accepted the position of special representative with the Sterling Electrical Manufacturing Company, where he remained until April 1, 1908, and resigned to accept the position of sales manager, motor department, of the Robbins & Myers Company. The latter company now announces his appointment as assistant general manager, taking effect November 1, 1910. Mr. Ramey is a Knight Templar, and member of Almas Shrine of Washington, D. C., is Past Exalted Ruler of Warren Lodge No. 295, B. P. O. E., and has been for years interested in the National Guard, both in Washington and Ohio. He is now Lieutenant-Colonel of the Fifth Ohio Infantry, and has occupied this position since May 30, 1902.

OBITUARY.

BENJAMIN NACHMANN, who has for many years been well known in Wall Street, died November 2, at his home in Yonkers, N. Y. Mr. Nachmann was born in England in 1855, coming to this country as a young man. He was for some years connected with the New York *World* and is also known as the man who devised the Western Union telegraphic code. He later established the International Cable Directory Company for the publication of the same. Mr. Nachmann was a member of the Consolidated Exchange and belonged to numerous lodges. He leaves a widow and three children.

GEN. JAMES JOURDAN, president of the Brooklyn Union Gas Company, died on November 1 at his home in Brooklyn, N. Y. His death was not unexpected, as he had been in very poor health for the past seven months. General Jourdan was about seventy-seven years of age at the time of his death and had during his life been prominent in military and political circles. During the Civil War he served as lieutenant-colonel and was later brevetted major-general for gallant services. His great activity in financial circles is shown by the fact that he was not only president of the Gas Company, but was a director in many other companies, including the Queens County traction companies, the Interborough-Metropolitan and the Interborough Rapid Transit companies, in which he was largely interested.

SIR CLIFTON ROBINSON, ex-managing director and chief engineer of the London United Electric Tramways, and a pioneer in the English street-railway field, died suddenly in New York on November 6. At the time of his death he was on a tour of inspection of Canadian railway properties. Sir Clifton was born in Birkenhead, England, sixty-two years ago. He was a pupil of George Francis Train and was closely connected with street-car enterprises throughout Europe and America, having constructed the first tramway in Europe in Birkenhead, England, in 1860. He was the pioneer of the system of cable and electric cars in Los Angeles, Cal., and electric traction in London. He constructed the first electric tramway in Bristol, England, in 1895, and designed and constructed the London United Electric Tramways system. Among his other activities he was an associate of the Institute of Civil Engineers, managing director and engineer of the London United Electric Tramways, a director and engineer of the Bristol Electric Tramways, and a director of the Metropolitan Division of the Underground Electric Railways of London and the Corris Railways.

NEW PUBLICATIONS.

CONSTRUCTION OF ELECTRIC FURNACES.—The Canadian Department of Mines has issued a bulletin entitled Recent Advances in the Construction of Electric Furnaces for the Production of Pig Iron, Steel and Zinc. This contains a list of all electric furnaces in use for refining steel.There are altogether 114 of these which have either been in use or are in course of erection. Descriptions are given of the experiments conducted in Sweden in smelting iron ores and of the construction of the Frick electric furnaces. The bulletin was prepared by Eugene Haanel, Ph. D.

STANDARDIZATION OF ELECTRICAL PRACTICE IN MINES —The Bureau of Standards, Department of Commerce and Labor, Washington, has issued circular No. 23, entitled "Standardization of Electrical Practice in Mines." This consists of a set of proposed rules for the installation and use of electricity in mines, explanatory notes to accompany the same, a short article on "The Dangers of Electric Wires and How to Avoid Them" and a summary of the mining laws in effect in various states and foreign countries. The circular is the result of more than a year's work by E. B. Rosa and Burton McCollum, and arose from the appointment of Dr. Rosa as chairman of the committee of the American Mining Congress in 1909. At the Goldfield meeting of the Congress in that year this committee was discontinued, but as considerable work had already been done it was considered advisable by the Bureau to continue it, and the present circular is the result of this investigation. The proposed rules cover definitions; general requirements; transmission lines and cables; switches; fuses and circuit breakers; motors; special rules for gaseous mines; and the electrical inspection of mines. It is to be noted that trained electrical inspectors are recommended for this work in addition to the regular mine inspectors. Copies of the circular may be obtained by application to the Director of the Bureau.

INDUSTRIAL ITEMS.

THE McROY CLAY WORKS, Brazil, Ind., has mailed to the trade its November blotter and calendar advertising McRoy conduits.

THE GOODWIN & KINTZ COMPANY, Winsted, Conn., is putting out a new "Highland" line of fixtures, including electric, gas and combination fixtures, showers and brackets.

H. B. CAMP COMPANY, Aultman, O., has issued a booklet giving comparative resistance and efficiency tests of conduits for electrical purposes made of vitrified clay, concrete and fiber.

THE FEDERAL ELECTRIC COMPANY, Chicago, Ill., mentions in the November number of *The Federalist*, both the desk type and the Type D Federal ozonizer. A number of outlet boxes and fixtures are also illustrated.

E. F. KIRKPATRICK, Chicago, Ill., announces that his address has been changed and is now 438 First National Bank Building. From this new location he will continue to handle electrical specialties and Grand Ledge clay conduit.

THE AUTOMATIC ELECTRIC COMPANY recently mailed to prospective telephone users two folders. One of these contains a number of facts about the automatic telephone system, while the other is a resumé of a number of letters from automatic telephone subscribers.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has distributed folders discussing the subject of modern street lighting by luminous arc lamps. The arrangement advocated in the booklet involves the use of constant-current transformers and mercury-arc rectifier sets.

W. N. MATTHEWS & BROTHER, St. Louis, mailed cards illustrating and describing the Matthews cable-splicing joint. One of the principal features of this joint is the ease of installation, and

it is claimed that anyone can successfully make the joint after reading the directions and practicing for a short time.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., recently mailed catalogs describing the "Hyray" lamp outfit for electrically lighting automobiles and motor boats. A number of head-lights, tail-lights and side-lights with accompanying fittings are illustrated, and a wiring diagram shows the proper method of installation.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, Chicago, Ill., announces that on November 7 its offices were moved to its new six-story building at 1014-1022 West Congress Street. The Company has greatly increased facilities and with its new equipment, will be in a better position than ever to give its customers prompt and satisfactory service.

THE R. D. NUTTALL COMPANY, Pittsburg, Pa., has recently made a considerable increase in its factory facilities. A new wing has been added to its building, which is located at the corner of Garrison and Fayette Ways. It is expected that the new structure, by greatly adding to the available floor space, will relieve some of the congestion that has existed in the plant. The Nuttall Company manufactures gears and pinions, trolleys, flexible couplings, etc.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has mailed to the trade its Catalog B-19 of Benjamin lighting specialties. The catalog is a completely revised and up-to-date reference book on Benjamin wireless clusters and lighting specialties. In listing its materials the principal object sought by the Company was to make every item easy of access. Illustrations and brief descriptive texts accompany many of the devices, furnishing essential information concerning their structure and character.

THE MOORE LIGHT COMPANY of Newark, N. J., manufacturers of the Moore Light, has opened a demonstration and sales room in New York at 500 Fifth Avenue. Moore light products—yellow and daylight white vacuum tube lights—are to be pushed vigorously from this new office. The regular business of installing long yellow-light tubes for general illumination is to be followed up actively, and some especially energetic work is to be done with a new small portable unit called the "Daylight-Window." This window has been designed especially for use in department stores, haberdashery shops, and all places where colors are dealt with. It gives an absolute reproduction of daylight, which shows colors accurately in their true values, and forms a complete and convenient matching cabinet.

THE MILLAR ELECTRIC COMPANY, Chicago, Ill., has entered the electrical heating field, and has established an office and factory at 222-224 South Canal Street. This Company is preparing for the Christmas trade an attractive and efficient electric toaster, which they will have ready for distribution about the first of December. The toaster itself is a radical departure in its field, and the simplicity, general attractiveness and efficiency will recommend it to all toast lovers. After the first of December the Company will bring out its other heating appliances, which will include practically a full line. The Company will confine itself strictly to a wholesale business, distributing its product only through jobbers and department stores. The officers of the Company are: R. M. Millar, president, and Francis Granger, treasurer and general manager.

DATES AHEAD.

American Association of Electric Motor Manufacturers. Semi-annual meeting, Chicago, November 14-16.

Alabama Light and Traction Association. Annual meeting, Anniston, Ala., November 21-23.

American Physical Society. Next meeting, Chicago, Ill., November 26.

American Association for the Advancement of Science, and affiliated societies. Minneapolis, Minn., December 27-31.

Iowa Electrical Association. Annual meeting, Davenport, Iowa, April 19, 20 and 21.

Directory of Electrical and Allied Engineering and Scientific Societies

(Published in the second issue of each month.)

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary, G. S. Emery, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West Thirty-ninth Street, New York, N. Y. Affiliated societies; American Electric Railway Accountants' Association, secretary, H. E. Weeks, Tri-City Railway Company; American Electric Railway Claim Agents' Association, secretary, B. B. Davis, Columbus Railway & Light Company, Columbus, O.; American Electric Railway Engineering Association, secretary, Norman Litchfield, New York, N. Y.; American Electric Railway Transportation and Traffic Association, secretary, H. C. Donecker, 29 West Thirty-ninth Street, New York, N. Y.; American Electric Railway Manufacturers' Association, secretary, George R. Keegan, 2321 Park Row Building, New York, N. Y.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, J. W. Richards, South Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, John Travell, 17 East Eleventh Street, New York, N. Y.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Secretary, John C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN IRON AND STEEL INSTITUTE. Secretary, W. J. Filbert, 30 Church Street, New York, N. Y.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West One-Hundredth-and-Sixteenth Street, New York, N. Y.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York, N. Y.

AMERICAN SOCIETY OF ENGINEERING CONTRACTORS. Secretary, Daniel J. Hauer, 13-21 Park Row, New York, N. Y.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, 239 West Thirty-ninth street, New York, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

ASSOCIATION OF EDISON PURCHASING AGENTS. Secretary, H. F. Frassee, Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Fred Brooks, 31 Mills Street, Boston, Mass.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, La Belle Iron Works, Steubenville, O.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railroad, Chicago, Ill.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Minnesota, St. Paul & Sault Ste. Marie Railroad, Chicago, Ill.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Ploda, Oak and Broderick Streets, San Francisco, Cal.

CALIFORNIA STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary and treasurer, F. V. Meyers, 502 Grant Building, San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Confederation Life Building, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 157 Bay Street, Toronto, Canada.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis, Ind.

CENTRAL ELECTRIC TRAFFIC ASSOCIATION. Secretary, J. T. Brittson, Chicago, South Bend & Northern Indiana Railway Company, South Bend, Ind.

CLEVELAND ELECTRICAL LEAGUE. Secretary, H. H. Cudmore, Brilliant Electric Company, Cleveland, O.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann, P. O. Box 922, Denver, Colo.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, F. D. Morris, Colorado Springs, Colo.

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ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago, Ill.

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ENGINEERS' SOCIETY OF MILWAUKEE. Secretary, R. H. Pinkley, Plankington House, Milwaukee, Wis.

ENGINEERING SOCIETY OF WISCONSIN. Secretary, W. G. Kerchoffer, 32 Vroman Building, Madison, Wis.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA. Secretary, Elmer K. Hiles, 2511 Oliver Building, Pittsburg, Pa.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

FRANKLIN INSTITUTE. Secretary, R. B. Owens, 15 South Seventh Street, Philadelphia, Pa.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. N. Bloomenthal, Chicago.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Mayer Building, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Preston S. Millar, Engineering Societies Building, 33 West Thirty-ninth Street, New York, N. Y.

INDEPENDENT TELEPHONE ASSOCIATION OF MISSISSIPPI. Secretary and treasurer, J. B. Shannon, New Albany, Miss.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

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INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Walter J. Uhl, Logansport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

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MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

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NATIONAL ASSOCIATION OF COTTON MANUFACTURERS. Secretary, C. J. H. Woodbury, Boston, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, O.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, N. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pine Street, Hartford, Conn.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, T. C. Martin, 33 West Thirty-ninth Street, New York, N. Y.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, McCormick Building, Chicago, Ill.

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NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Alton F. Tupper, 84 State Street, Boston, Mass.

NEW ENGLAND SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION, Secretary, L. D. Gibbs, 39 Boylston Street, Boston.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 Thirty-ninth Street, New York, N. Y.

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ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, Roy M. Van Vliet, Monadnock Block, Chicago, Ill.

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PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, Van Dusen Rickert, Pottsville, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

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SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF AUTOMOBILE ENGINEERS. Secretary, Alexander Churchward, 30 Church Street, New York, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. D. Forbes, 96 Franklin Street, South Framingham, Mass.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, W. B. Head, Stephensville, Tex.

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TELEPHONE SOCIETY OF NEW YORK. Secretary, T. H. Lawrence, Eighteenth Street and Irving Place, New York, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Leon Spencer, Gainesville, Tex.

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VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

WASHINGTON SOCIETY OF ENGINEERS. John C. Hoyt, 1330 F Street, Washington, D. C.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe Street, Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS. Secretary, J. H. Warder, Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C Crowley, Jr., Superior, Wis.

WISCONSIN STATE TELEPHONE ASSOCIATION. Secretary, Paul J. Weirich, Monroe, Wis.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 1, 1910.

974,109. CIRCUIT-INTERRUPTER. Carl B. Auel, Wilkinsburg, Pa., and John R. Spurrier, Manchester, England, assignors to Westinghouse Electric and Manufacturing Company. Filed September 4, 1906. A fuse is in series with oil-immersed co-operating, latch-engaged contact members which are separated when the fuse is ruptured.

974,110. TELEPHONE APPARATUS. Garrison Babcock, Rochester, N. Y., assignor to Simplex Telephone Equipment Company, Rochester, N. Y. Filed May 8, 1908. A current-modifying medium is situated between a rigid and a flexible electrode.

974,112. CIRCUIT-CONTROLLING MECHANISM. Ferdinand Bechoff, Schenectady, N. Y., assignor to General Electric Company. Filed December 16, 1908. Prevents simultaneous operation of two independently operable switches.

974,152. ELECTRIC-MOTOR CONTROL. Henry D. James, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed March 4, 1907. The switches are caused to close in a predetermined order and to open automatically in the same order.

974,157. THERMO-ELECTROSTAT. Roscoe William King, Las Animas, Colo. Filed June 11, 1909. Expansion or contraction of a fluid by heat or the lack of it controls electric contact devices.

974,161. HEATING SYSTEM. Hermann Lemp, Lynn, Mass., assignor to General Electric Company. Filed May 10, 1910. The apparatus comprises a vessel containing a liquid to be heated and also a body of mercury, conduits conveying liquid to the vessel and liquid or vapor therefrom, a pump that is normally in operation continuously to supply liquid to the vessel, a regulator for the motor that is sensitive to change in level of the liquid in the vessel, conductors for conveying current to the vessel and receiving it after it has passed through the mercury and the liquid, and a regulator for controlling the passage of current which is sensitive to a condition of the liquid being heated.

974,167. TRANSFORMER. Max Mayer, Pankow, Germany, assignor to General Electric Company. Filed May 3, 1909. A multileg core-type transformer.

974,169. TRANSMITTING APPARATUS. Frederick W. Midgley, Jersey City, N. J., assignor to International Telegraph Construction Company. Filed February 1, 1906. A wireless transmitter for long-period waves.

974,171. RECTIFYING ELECTRIC CURRENTS. John J. Montgomery, Santa Clara, Cal. Filed Aug. 28, 1909. The process consists in giving to a moving element through the agency of a fixed element, a succession of positive and negative accelerations, the resultant effect of which determines a step-by-step progression of the moving element in exact consonance with the variations of the current to be rectified, and in imparting the step-by-step movement so determined, to an element of a pole-changing device adapted to co-operate with other elements connected to the circuit carrying the current under rectification, to successively reverse the order of the terminal connection of the circuit carrying the current under rectification to a utilization circuit, by the step-by-step movement imparted to the element of the pole-changing device.

974,177. INSULATOR FOR HIGH-TENSION TRANSMISSION SYSTEMS. Jakob E. Noeggerath, Schenectady, N. Y., assignor to General Electric Company. Filed February 9, 1910. Anchor slugs are disposed in a passage between the bearing afforded by the space between flanges on the head of a strain bolt, and a shouldered recess in the insulator proper.

974,190. CURVE-DRAWING INSTRUMENT. Lewis T. Robinson, Schenectady, N. Y., assignor to General Electric Company. Filed March 30, 1903. An electromagnetic autographic recorder.

974,191. WIRELESS APPARATUS. Frederick G. Sargent, Westford, Mass. Filed April 3, 1909. A detector comprises a conductor supported at two points and free to vibrate between them, and a contact point lightly engaging it and adjustable transversely along the conductor.

974,192. ELECTRIC METER. George A. Sawin, Lynn, Mass., assignor to General Electric Company. Filed September 13, 1906. The meter shaft is caused to be separated from its bearing by a cessation of the flow of current.

974,207. INSULATOR-SUPPORT. Warren Ray Thompson, Chicago, Ill., assignor to H. M. Byllesby & Company, Chicago, Ill. Filed May 10, 1910. An insulator support comprises angle bars connected to each other at one end, and diverging from their points of attachment to each other, so that their opposite ends will be separated, the bars being adapted to be connected between their ends to a pole or other support.

974,220. ELECTRIC INSOLE. Charles W. West, Denver, Colo., assignor to The Electro-Curo Company, Denver, Colo. Filed March 23, 1908. Electrodes in a boot or shoe insole connect to a portable battery.

974,223. LIGHTNING-ARRESTER. Alexander Jay Wurts, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed September 5, 1905. An electrical fuse comprises a nonconducting frangible body and a fusible conducting film covering its surface the fusing of which breaks the frangible body and produces only a negligible amount of conducting vapor.

974,224. ELECTRIC BRAKING. Ernest F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed October 9, 1909. The method of operating an alternating-current commutator motor as a generator returning energy to the source for dynamic braking, consists in connecting the motor armature to the source, separately exciting the motor field with current approximately in phase with the voltage of the source, varying simultaneously the connections between the motor armature and the source and the strength of the current, supplied to the motor field to vary the braking torque, and varying the strength of this current independently to adjust the motor voltage for different speeds.

974,225. BRIDGE FOR SUPPORTING TROLLEY-WIRES BY MEANS OF THE CATENARY SYSTEM. Robert L. Allen, Syracuse, N. Y. Filed August 27, 1909. A truss comprises upper and lower chords, and posts of angle iron interposed between the chords, each post having its end sections flattened, and each flattened end section having its outer portion bent at an angle to the remaining part of the flattened section and secured to one of the chords.

974,227. ELECTRODE FOR ARC-LAMPS. Edward Berry and Emile J. Guay, Lynn, Mass., assignors to General Electric Company. Filed July 9, 1909. An arc-light electrode is composed of an aluminum tube with a filling of titanium carbide.

974,232. ELECTRICAL SAD-IRON. William A. Braun, Fort Wayne, Ind., assignor of one-half to Fremont L. Jones, Fort Wayne, Ind. Filed February 23, 1910. An expansive element cuts off the current when the heat becomes excessive.

974,238. MOTOR CONTROL. Andrew M. Coyle, New York, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed January 30, 1908. Includes means for energizing either a brake magnet alone or both a brake magnet and a trip magnet when current is supplied to the motor.

974,253. LAMP-FIXTURE. Peter Forg, Somerville, Mass. Filed November 14, 1907. An adjustable pendant fixture for incandescent lamps.

974,275. ILLUMINATED SIGN. William H. Ingle, Tacoma, Wash. Filed August 17, 1909. An electric flasher.

974,279. AUTOMATIC TELEGRAPHY. Gregory T. Kanzer-Chegodard, Kamenka, Russia. Filed March 31, 1903. A plug comprises two metallic spring plates electrically insulated from

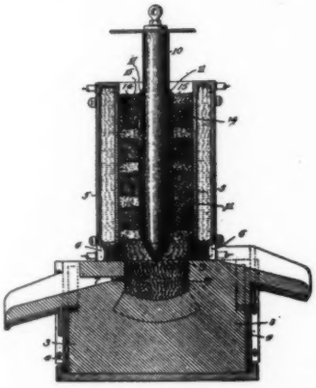
each other and having forked ends adapted to embrace the upper and lower front contacts of a Morse key.

974,296. ELECTRO GLOW-LAMP. Hermann Remané, Berlin; Emil Gottschalk, Charlottenburg, and Eugen Hurwitz, Berlin, Germany, assignors to Deutsche Gasglühlicht Aktien Gesellschaft (Auergesellschaft), Berlin, Germany. Original application filed July 18, 1907. Divided and this application filed December 17, 1908. An incandescent electric lamp comprises a tungsten filament and a support therefor, composed of two separable bodies of metals connected mechanically, one of the metals having the property of forming an alloy with tungsten, while the other has the contrary property.

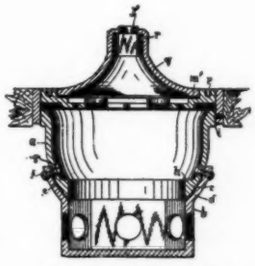
974,329. ELECTRIC HEATING DEVICE. Christian Aalborg, Wilkinsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed November 19, 1908. An electric heating device comprises a zigzag grid of flattened fluid-containing tubing and resistance elements forced into engagement with the outer surfaces of the flattened tubing and insulated therefrom.

974,330. ELECTRICALLY-HEATED BOILER. Christian Aalborg, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed July 8, 1909. An electrically heated steam generator comprises a relatively flat resistance element, a receptacle having ribs or projections on the inner surfaces of its walls, and slots cut in its outer wall and extending into the projections or ribs to receive the resistance element, whereby the fluid pressure within the receptacle comprises the resistance element.

974,362. RAILWAY-SIGNAL. James J. Cozzens, East Orange; Charles F. Estwick, Jersey City, and George S. Tiffany, Summit, N. J., assignors to The Kinsman Block System Company. Filed April 2, 1910. An electromagnetically operated semaphore.



970,608.—ELECTRIC SMELTING



970,370.—FLOOR BOX.

974,370. UNIVERSAL FLOOR-BOX FOR THE DISTRIBUTION OF ELECTRIC WIRES. John Fountain, Jr., Elizabeth, N. J. Filed June 24, 1904. Renewed March 31, 1910. A floor box has two adjustable box body sections, one section provided with an outwardly projecting flange, and the other with an inwardly projecting flange, the flanges being provided with bearing seats, whereby the box sctions are capable of universal adjustment one upon the other upon the flanges.

974,374. REFLECTOR FOR STORE-WINDOWS AND THE LIKE. Thomas Gaggs, Chicago, Ill., assignor to Thomas H. Sidney, Chicago, Ill. Filed Aug. 19, 1909. A reflector for store windows and the like comprises a downwardly facing, trough-shaped upper part, an upwardly facing, trough-shaped lower part and an inwardly arched reflecting back wall extending between the upper and lower parts.

974,389. ELECTRODE FOR ELECTRIC-ARC LIGHTS. Adrian Denman Jones, Holloway, England. Filed April 19, 1909. An arm-lamp electrode comprises a carbon core, members projecting from the core, and chemical material disposed around the core between the projecting members, the latter being shaped so as partially to inclose the chemical material, to hold it in place.

974,396. LIGHTNING-ROD. Edward J. Kress, Pittsburg, Pa., assignor to William M. Leatherman, Pittsburg, Pa. Filed October 10, 1908. Renewed May 11, 1910. A lightning rod comprises a core of absorbent material, and a woven wire tube, incasing the core, and having interspaces.

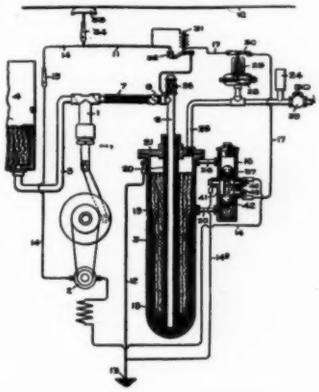
974,415. PROCESS FOR COMPELLING ELECTRIC MOTORS TO KEEP IN STEP WITH THE WAVES OR IMPULSES OF THE CURRENT DRIVING THEM, AND A MOTOR EMBODYING THE PROCESS. John J. Montgomery, Santa Clara, Cal. Original application filed August 28, 1909. Divided and this application filed April 6, 1910. The method consists in giving to the moving element in the motor through the agency of a fixed element, a succession of positive and negative accelerations, the resultant effect of which determines a step-by-step progression of the moving element in exact consonance with variations in the current applied, so that when the current is applied and the movable element brought in synchronism by the application of an extraneous force, the attraction of the field magnet will first pull the movable element forward and will then hold it back in such manner that it will continue to advance with a step or movement undulatory in its character, the successive steps or undulations being in response to the successive variations of the electrical forces, and in synchronism with and conterminous as regards time with such variations, whether such variations occur in successively equal times or not.

974,420. APPARATUS FOR HEATING TOOLS ELECTRICALLY. John Aertly, Cincinnati, Ohio, and Charles F. Dudley, Bellevue, Ky., assignors to O. A. Miller Treeing Machine Company. Portland, Me. Filed April 6, 1907. An electrically heated treeing iron.

974,433. SPEED REGULATION FOR DYNAMO-ELECTRIC MACHINES. Clarence Renshaw, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed August 2, 1905. A motor has a field magnet connected to one phase of a polyphase circuit and an armature connected to another phase thereof; an auto-transformer is interposed between the armature and the circuit, and means dependent upon the current traversing the circuit automatically vary the active length of the transforming winding.

974,439. ELEVATOR. Martin C. Schwab, Chicago, Ill. Filed April 27, 1909. An electric switch is adapted to be operated by the relative movement of a suspended weight and the car.

974,447. MAGNETIC TRACTION-WHEEL DRIVE. August Sundh, Yonkers, N. Y., assignor to Otis Elevator Company, Jersey City, N. J. Filed Dec. 16. 1905. A brake device for a traction elevator is described.



974,161.—HEATING SYSTEM.

974,449. TERMINAL CONNECTION. Otto Thieme, St. Louis, Mo. Filed October 28, 1909. The turned-up ends of the cable wires are held between washers squeezed together by a device similar to a screwed stuffing box.

974,462. ELECTRICAL COUPLING. Carl H. Bissell, Syracuse, N. Y., assignor to Crouse-Hinds Company, Syracuse, N. Y. Filed January 27, 1910. A T-joint connection.

974,497. ELECTRIC GENERATOR AND MOTOR. Duston Kemble, Lakewood, Ohio. Filed January 13, 1910. The field magnets are formed with longitudinal openings therethrough, and an inner coil and an outer coil are wound within and about the magnets respectively, the inner coil being disposed in a plane substantially at right angles to the outer coil.

974,506. TELEPHONE-RECEIVER HOLDER. Harry M. McAlarney, Puritan, Pa. Filed September 1, 1910. The receiver is supported by a bracket device connected to a desk-type transmitter.

974,528. ELECTRIC SWITCH. William M. Scott, Philadelphia, Pa., assignor to The Cutter Electrical and Manufacturing Company. Filed October 9, 1909. The switch comprises movable main and shunt contacts, and arm carrying a shunt contact independently of the main contact, members pivoted to each other for operating the main contact, a cam surface on the shunt-carrying arm, and a cam-engaging member carried at the pivotal connection of the members for operating the shunt-carrying arm.

974,557. ELECTROCHEMICAL WARP STOP-MOTION FOR LOOMS. John F. Dustin, Fulton, N. Y., assignor of one-half to John W. Stevenson, Fulton, N. Y. Filed April 22, 1910. Breakage of a thread closes a controlling circuit.

974,561. ELECTRIC WATCHMAN'S CLOCK. George B. Fessenden, Boston, Mass., assignor to The Eco Magneto Clock Company, Boston, Mass. Filed July 23, 1908. An autographic recording mechanism is described.

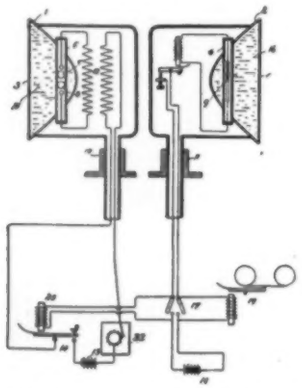
974,562. INDICATING AND RECORDING MECHANISM. Theodore M. Foote, Allston, Mass. Filed May 2, 1910. Signal-recording mechanism comprises a recording element and thermostatically operated controlling means therefor disposed in proximity to a light, the burning of which is to be recorded.

974,565. AUTOMATIC GAS-IGNITER. Eugene E. Gerald, Baltimore, Md. Filed March 23, 1910. The gas jet is ignited by an electric attachment the current for which is thermostatically cut off when the gas is lighted.

974,568. SHADE-HOLDER. Edwin E. Hayward, Waterbury, Conn., assignor to The Plume & Atwood Manufacturing Company, Waterbury, Conn. Filed July 23, 1910. A shade holder includes a socket-holding device.

974,576. ELECTROLYTIC CELL. Gilbert C. Landis, Wadsworth, and Jacob H. Smith, Rittman, Ohio, assignors to Ohio Salt Company, Wadsworth, Ohio. Filed July 2, 1909. An electrolytic cell consists of a container; two series of electrodes mounted in the container to form a tortuous path through the same for the electrolyte; a series of tubes of electrical nonconducting material each in the form of a series of substantially parallel convolutions; one of the tubes being mounted between each pair of electrodes; with two supply pipes each connected to each of the tubes for circulating cooling fluid therethrough.

974,584. TROLLEY. George A. Miller, McKeesport, Pa. Filed April 21, 1910. A special harp construction.



974,762.—WIRELESS APPARATUS.

974,608. PROCESS FOR SMELTING ORE. Frederick T. Snyder, Oak Park, Ill., assignor to Electric Metals Company, Chicago, Ill. Filed July 1, 1907. The process of making steel from iron ore in an electric furnace consists in feeding such ore mixed with sufficient carbon to reduce such ore and provide the required carbon contents of the steel, while preventing the absorption of additional carbon by shielding the electrodes with lime (the lime being adapted to flux the earthy constituents of the ore), and collecting the metal in a crucible free from carbon.

974,610. STRAIN-INSULATOR. Louis Steinberger, New York, N. Y. Filed June 17, 1910. A strain insulator comprises a body member provided with a recess and with an opening merging into the recess, a single metallic tension member extending through the opening and provided with an anchor disk located within the recess, metallic tension members disposed upon opposite sides of the single metallic tension member, and means for anchoring the tension members relatively to the body member.

974,611. TROLLEY-HARP. William W. Stewart, Muskogee, Okla. Filed December 7, 1909. A cable hanger comprises a support-a displaced trolley wire to the wheel groove.

974,669. CABLE-HANGER. Elijah Gordon Jeffries, Boise, Idaho. Filed December 7, 1909. A cable hanger comprises a supporting member and a suspending member pivotally connected together, these members having juxtaposed concave faces arranged in opposition to each other, and means on one of the members adapted to lockingly engage a cable, whereby the members are locked against relative movement.

974,672. INSULATOR. Robert M. Johnston, Mansfield, Ohio, assignor to The Ohio Brass Company, Mansfield, Ohio. Filed December 23, 1907. In combination with a series of interchangeable insulator sections detachably swiveled together is a suspension means attached to the ends of the series.

974,683. CONTROLLING SYSTEM FOR MOTOR TRACTION-CARS. William C. Mayo, Barstow, Tex., assignor of one-third to Electric Gas Motor Car Company, one-third to George E. Briggs, Barstow, Tex., and one-third to John Houlehan, El Paso, Tex. Original application filed February 24, 1908. Divided and application filed November 3, 1908. Divided and this application filed December 29, 1909. There is a speed-changing mechanism between the power side of the car and the car axles, with electric controlling means for this mechanism, and means for establishing electric connection on the lowering speed silde of the speed-changing mechanism when the main controlling circuit therefor is broken.

974,687. ELECTRIC-LIGHT HANGER. Norman McLeod, Detroit, Mich. Filed Dec. 4, 1909.

974,712. ARMATURE-TESTING DEVICE, Levon H. Seyranian, Monterey, Cal. Filed Dec. 29, 1908. The device comprises two movable contacts forming terminals of an electric circuit including a buzzer and adapted to make electrical connection with two commutator bars, and two fixed contacts included in an indicating circuit adapted to be closed by the movable contacts of the buzzer circuit.

974,760. ELECTRIC FISHING-TOOL. Harry Eastwood, Fresno, Cal. Filed Feb. 2, 1910. A fishing-tool consists of a waterproof casing with a removable, sectional armature plug in the bottom, and means within the casing for magnetizing the armature sections.

974,762. WIRELESS TELEGRAPHY. Reginald A. Fesseden, Washington, D. C. Filed Jan. 14, 1907. In combination with a receiving apparatus and a transmitting apparatus, are means (for shielding the receiving apparatus from the action of the sending apparatus during the simultaneous operation of the sending and receiving apparatus) comprising a focusing device for receiving the waves and focusing device for emitting the waves, both focusing devices being filled with a medium having a higher dielectric constant than air, so that the waves as emitted and received are of much shorter wave length than when traversing the space between the stations.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office, Washington, D. C.), that expired November 7, 1910:

507,978. INCANDESCENT ELECTRIC LAMP. Craig R. Arnold, Sharon Hill, Pa.

507,983. AUTOMATIC SIGNAL FOR TRUNK LINES OF TELEPHONE EXCHANGES. Oro A. Bell, Brooklyn, N. Y.

507,997. ELECTRIC LOCOMOTIVE. Joseph I. Conklin, Brooklyn, N. Y.

508,000. ELECTRIC-MOTOR APPARATUS. John C. Davidson, Prince's Bay, N. Y.

508,006. ELECTRIC-LIGHT FIXTURE. Larsen Filstrup, Chicago, Ill.

508,050. CIRCUIT-BREAKING DEVICE FOR RECIPROCATING ELECTRIC MACHINES. Charles H. Richardson, Philadelphia, Pa.

508,054. MULTIPLE-SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES. Charles E. Scribner, Chicago, Ill.

508,069. POLARITY SWITCH FOR SECONDARY-BATTERY SYSTEMS. Allen H. Whiting, New York, N. Y.

508,083. ELECTRIC-RAILWAY SYSTEM. Carl T. B. Brain, Liverpool, Eng.

508,089. SAFETY APPARATUS FOR ELECTRIC OR OTHER STREET-RAILWAY CARS. William Cox, Hamilton, Canada.

508,129. ELECTRIC MOTOR. William P. Carstarphen, Jr., Denver, Colo.

508,188. ALTERNATE CURRENT ELECTRIC MOTOR. William Stanley, Jr., Great Barrington, Mass.

508,199. CLOSED-CONDUIT ELECTRIC RAILWAY. Otis B. Benton, Cleveland, Ohio.

508,208. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Albert M. Cullingworth, New York, N. Y.

508,215 ELECTRIC TIME-SIGNALING SYSTEM. James H. Gerry, Brooklyn, N. Y.

508,236. CONDUIT ELECTRIC RAILWAY. Jacob Pawolowski, Cincinnati, Ohio.

508,255. TELEPHONE CIRCUIT. John S. Stone, Boston, Mass.

508,262. ELECTRIC TOOL. George H. Williams, New York, N. Y.

508,284. ELECTRICALLY-HEATED SOLDERING IRON. Charles L. Coffin, Detroit, Mich.

508,295. ELECTRIC CABLE. Henry W. Fisher, Pittsburg, Pa.

508,322 ELECTRIC REGULATOR AND SWITCH. Walter N. JONES, Jr., Petersburg, Va.

508,356. RAILROAD SIGNAL SYSTEM. George L. Thomas, Brooklyn, N. Y., and Edward C. Seward, Montclair, N. J.

508,370. COVERING ELECTRIC CONDUCTORS. William A. Conner, Pittsburg, Pa.

508,373. ELECTRIC-CAR ATTACHMENT. Isaac H. Davis, South Butte, Mont.

508,380. ELECTRIC ROTARY FLUE-CLEANER. Fulton Gardner, Chicago, Ill.

508,388. ELECTRIC RAILWAY. Rudolph M. Hunter, Philadelphia, Pa.

508,392. ELECTRIC-ARC LAMP. Benjamin Adair and Charles H. Klewer, Denver, Colo.